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The Ninth World Conference on Earthquake Engineering, August 2-9, 1988, Tokyo & Kyoto, JAPAN

Seismic Response of Concrete Stave Silos With Structural Discontinuity

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Concrete stave silos are segmental structures which are cylindrically assembled from precast concrete blocks called "staves" and held together by exterior pretensioned steel hoops. These stave silos have widely been utilized in the U. S. A. and Canada as industrial and agricultural storage facilities. The purpose of this research was to clarify the seismic response behavior of the stave silos with such structural discontinuity through a series of shaking table tests. The effects of stave joints and stored materials on the dynamic behavior are also investigated.

On the basis of the experimental results obtained, the following conclusions can be drawn. The hysteretic restoring force characteristics of stave silos are caused by not only the damping effect of stored materials but the structural discontinuity. It is possible to interpret the nonlinear response behavior of stave silos during earthquakes from a soft-spring type of the hysteretic characteristics.

The 9th International Symposium on Ice, August 23-27, 1988, Sapporo, Japan

Variability of Ice Growth Characteristics in Lake Haruna, Japan

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Lake Haruna has been subjected to an investigation as to characteristics of ice growth, using data since 1960 of daily mean air temperature and daily thickness of the ice cover (I), and calculating degree-days of frost (R), beginning from the day when cumulative daily mean air temperature culminated each winter, which are used as absolute values.

Analyzing the data using the Stefan's law, $I^2 = a\,(R-R_0)$, two constants a and R_0 were chosen as the parameters of ice growth characteristics, where R_0 is the value of degree-

days of frost on the day of first freeze-over. These parameters have varied with the year since the winter of 1973-74 toward a trend in which the date of first freeze-over delays and the ice growth rate decreases. Considered to be the cause of the variation is an increase in amount of heat from warm water inflow which changes thermal conditions for lake ice growth.

The Second East Asia-Pacific Conference on Structural Engineering & Construction Chiang Mai, January 11-13, 1989

Free Vibration Analysis of Rigid-Frame Bridges with V-Shaped Legs

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Three different analytical mass matrix methods for determining dynamic characteristics of in-plane vibrating rigid-frame bridges with V-shaped legs are presented. One method is the exact method based on the general solutions of the differential equations of motion for both axial and flexural vibrations, and it is called the continuous mass method. The other two matrix methods are the lumped and consistent mass methods based on the approximate finite element approach. The numerical results computed by the lumped, consistent, and continuous mass methods are given in tabular form, and their accuracy is investigated.

Proceedings of Ninth World Conference on Earthquake Engineering
Tokyo-Kyoto, August 2-9, 1988

Dynamic Response Analysis of a Five-Span Continuous Rigid-Frame Bridge with V-Shaped Legs

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Dynamic response analysis is performed of a five-span continuous rigid-frame steel bridge with V-shaped legs standing on two reinforced concrete piers. Three different analytical matrix methods for determining the dynamic characteristics of in-plane vibrating rigid-frame bridges are presented. The numerical results computed by using the lumped, consistent, and continuous mass methods are given in tabular form, and their accuracy is evaluated. Also, the Square-Root-of-Sum-of-Squares (SRSS) method and the Complete Quadratic Combination (CQC) method are used for seismic analyses that combines modal maxima. The calculation results are compared with those resulting from a time history response analysis.

Second International Conference on Performance of Concrete in Marine Environment. St. Andrews by-the Sea, Canada August 21-26, 1988

Control of Rust Damage of Reinforced Concrete in a Corrosive Environment

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A new index has been suggested for controlling and protecting reinforced concrete from corrosion. This index defined as the difference in the average strain between concrete and reinforcing bar, is tentatively called the cracking index. On the basis of the exposure tests, relationships between the cracking index and the rust thickness of reinforcing bars in concrete are evaluated under corrosive atmosphere. Cracking index could be used for the assessment of corrosion. The relationship between the critical rust, which is the rust thickness of reinforcing bars at the onset of longitudinal cracking, and cover thickness is obtained by rapid corrosion tests. It is concluded that the allowable stress for reinforcing bars thus the corrosion can be controlled by the required amount of concrete cover.

IAHR 9th International Symposium on Ice Aug. 1988 (Sapporo)

Permeability Coefficient of Sea Ice Formed within Sands and Gravels Fills

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Summary

Recently caisson type structures have been employed as offshore structures in extreme cold regions. As the liquid, sand or gravel filling proceeds, the caisson freezes and the internal pressure rises. It has previously been verified that this pressure rise, due to an increase of volume caused coefficient of the sea ice forming within the sand and gravel.

Presented in this paper are results of an experiment on the permeability coefficient of sea ice which contains sands and gravels and the analysis needed to estimate the internal pressure in a caisson structure constructed in a cold region.

IAHR 9th International
Symposium on Ice
Aug. 1988 (Sapporo)

Experimental Study on Sea Ice-Concrete Sliding Abrasion

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Summary

Many Maritime structures such as breakwaters, goins, Lighthouses, bridgepiers and offshore structures have been constructed in cold regions. Although often structure surfaces have been damaged by both freeze-thaw action or abrasion due to sea ice sheet movement. Therefore design of offshore concrete structures in cold regions requires clasification of the amounts of sea ice-concrete sliding abrasion.

The authors have conducted 4 years of systematic experiments using newly developed abrasion test apparatus, and clarified the relations between abrasion rate of cocrete surface and various factors.

The 8th International Conference of Offshore Mechanics and Arctic Engneering, ASME
Mar. 1989 (Hague, Holland)

Durability of Coated Steel in Sea Ice Regions

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Nippon Steel Corporation
H. SAEKI
Hokkaido University

Summary

Polyethylene and polyurethane coating are now widely applied to steel piles. In sea ice regions, these coatings are subjected to ice attack and experience compressive forces, impact, wear and adfreezing. However, these actions of ice on coating have yet to be clarified. The durability of these coating in sea ice regions was investigated with new methods, and polyurethane coatings were found to be the best among concrete, uncoated steel and various coatings investigated, because these two coatings were durable against impact and compressive forces of ice, and adhension strength and wear by ice were smallest.

The 5th World Conference on Transport Reseach, Yokohama, Japan, July 10-14, 1989

The Opening Effect of the Seikan Tunnel in Passenger and Freight

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This papaer is made to analyze passengers and freight before and after the Seikan Tunnel went into service in March, 1988 and examine the effect of the Seikan Tunnel. The Seikan Tunnel is the largest tunnel (23.30 km undersea, 30.55 km under land), in the world.

We made a time series analysis of a monthly change in the number of passengers and its short-term prediction, using the EPA (Economic Planning Agency) method. The

number of passengers in April, 1988, was double that of the same month, 1987. It is considered that the Seikan Tunnel will have such a large impact on the increase to exceed that tendency.

As for freight, we performed in the similar way. It became that the actual values far exceeded the predicted values.

Lastly, we discussed the freight systems of the Seikan Tunnel, using this Activity Diagram.

2nd International Symposium on Pavement Evaluation and Overlay Design, September 11-15, 1989, Rio de Janeiro Brazil

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Development of Pavement Evaluation System Using the Falling Weight Deflectometer

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Pavement surface condition data play a principal role in the evaluation of pavement serviceability. Similarly, pavement structural condition data are essential for the diagnosis of pavement soundness. This paper describes a new pavement evaluation system using the Two-Mass Falling Weight Deflectometer (FWD).

It is found that force pulses given by two falling masses are highly reproducible with their shapes being nearly the same as those produced by actual moving wheel loads and that dynamic deflections measured by the FWD are considerably different from those based on the Benkelman beam.

It is concluded that the combination of the measured deflection data with the multi-layer elasticity theory yields the reasonable evaluation of seasonal fluctuations and local variations of subgrade condition, subbase strength, stiffness moduli of asphalt mix layers, etc.

First International Conference on Snow Engineering
Santa Barbara, California,
U. S. A., July 1988

Wind Effect on the Distribution of Snow Depth on a Large Dome

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Snow depth on a large dome of 103-m diameter and about 32-m height was measured in Sapparo, where we have heavy snow accumulation and varying winds. It was found that the mean snow depth on the entire roof area measured at 36 points was about 70% of the ground snow depth. The maximum snow depth measured on the roof was 120 cm, which was about 1.4 times the ground snow depth. The ratio of the mean snow depth on the scoured half surface of the roof to the mean snow depth on the drifted half surface was about 1 : 2. The most frequent wind direction, measured with a propeller-type anemometer on the roof, did not correspond to the direction inferred from the snow drift distribution. It was observed that a wind with a velocity greater than about 5-6 m/s was effective in causing the snow drift on the roof, when the mean air temperature during the referring period was about −4°C. This measurement suggests that it is not adequate to predict the probable snow drift distribution on a roof immediately from the most frequent wind direction in the snowfall period.

Ninth World Conference on Earthquake Engineering
Tokyo-Kyoto, August 2-9, 1988

Behavior of Three-Dimensional Reinforced Concrete Beam-Column Subassemblages With Slabs

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The experimental study is carried out to clarify the shear resistance behavior of interior beam-column joints in two-way reinforced concrete frames. Four three-dimensional subassemblages with slabs are used as specimens to which lateral cyclic forces are

applied in two directions perpendicular to each other by changing the direction alternately at every cycle. On the basis of the results of experiment and calculation, effective width of slab participating to bending strength of beams, ultimate strength of joints, effectiveness of the joint stiffness in story drift and energy absorption are discussed. As for the ultimate strength of joints, adaptability of two equations previously proposed in Japan and reasonability of the requirements of ACI Code and New Zealand Standard also are discussed in comparison with the test results.

Ninth World Conference on Earthquake Engineering Tokyo-Kyoto, August 2-9, 1988

Influence of Transverse Reinforcement in Joints and Beam Ends on the Behavior of R/C Beam-Column Subassemblages

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In the earthquake-resistant design of reinforced concrete frames, the slippage of beam bars from the joint shall be avoided because it will reduce the energy absorbing capacity of frames. To avoid such slippage, the confinement of core concrete in members may have some influence to the limitation of the deterioration of bond stress. The experimental work was carried out in order to know the influence of transverse reinforcement in joints and/or the connecting ends of beams on the behavior of R/C beam-column subassemblages. The test results showed that the heavy transverse reinforcement in joints reduced the slippage of beam bars from the joint and enhanced the joint stiffness after cracking, and that the like reinforcement in the beam ends had few effect on relieving the stiffness degradation of frames after yielding. One of specimens that had been treated as to be bondless within the joint region of the beam bars developed enough ductility but low energy absorption.

International Conference of
CIB, Healthy Buildings 88,
Stockholm, September 4-8,
1988

On the Characteristics of Fluctuating Room airflow of a House Called MACHIYA in the High Density District in KYOTO City

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In the high density district in Kyoto city, there are one of the traditional japanese wooden houses called Machiya. In spite of these location, the atomosphare in the Machiya gives us a cool image even when the outdoor temperature is so hot. This reason is mainly by the effect of low temperature of naked ground at the inner gardens that are protected from the solar radiation by hanged over eaves. The temperature difference between two gardens and the wind of outside make the fluctuating air flow at the interior space. This fluctuating air flow will produce the good effect for thermal comfort. The authors measured the fluctuating air flow in the Machiya by use of heat productable cylinder and measured pressure difference between two gardens. Consequently, the cause of a cool image in the Machiya were known.

ISCORD 88
International Symposium on ColdRegion Development 1988
Harbin, China 9-13 Augest 1988

A Tentative Proposal for the Planning Arrangement of Apartment Houses in a Winter City

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Hokkaido is the northernmost island of Japan. The outdoor temperature falls to −15 ∼−30°C in winter and snowfall often reaches 1.5 m in places. When an arrangement of apartment houses is being planned, most arrangements are designed to utilize the advantages of southern exposure due to the consideration of the solar and the outdoor conditions in winter.

In this report, we will propose a planning arrangement that the facades of two

International Conference of
CIB, Healthy Buildings 88,
Stockholm, September 4-8,
1988

INVESTIGATION ON THE TRADITIONAL TOWN HOUSE CALLED "MACHI-YA" IN KYOTO

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A large part of Japanese country belongs to the Monsoon Temperate Zone. Its climate has a wide variation of temperature through the year and is especially sultry in summer. Kyoto is one of sultry city in Japan. Out door temperature sometime rises up to 35°C and relative humidity is over 85% in summer. In Kyoto, there are peculier traditional woody dwellings called "Machi-ya" and it holds the refreshing space without the air conditionings. They were constructed under the concept "Comfortable Living in Summer". The characteristics of space composition and dwellers' view of summer conditions of "Machi-ya" are discussed in this paper.

"Machi-ya" is generally a two-storied town house and its plan is formed as a stripped rectungular with short frontage because of being exempt from taxation in old times. They have common long-side-wall with the next houses and it separate them each other. The composition of space of "Machi-ya" is characterized mainly by the unfloored passage with high roof called "Toori-niwa" and the small inner-garden called "Tsubo-niwa". "Tsubo" is Japanese unit and means small area.

The authors visited the "Machi-ya" and investigated by hearing from occupants about a living situation etc, and estimated the reason of refreshing of "Machi-ya" as follows ;

- ○ Inner-gardens have an effect on the natural discharge of warm air
- ○ The various softly air current of inside of "Machi-ya" are created by the small difference of atomospheric pressure between inner-gardens
- ○ Naked grounds of inside of "Machi-ya" are mintained more cool than out door temperature by shading from solar-radiation and evaporation etc
- ○ The water sprinkled on the inner-gardens is also important to get the refreshing effect

There are skillfull control of Micro-Climate using natural energy.

Asian Conference on Fluidized-Bed and Three-Phase Reactors
December 14 - 17, 1988, Tokyo, Japan

Particle Size Distribution Effect on the Composition of the Mixed Layer in Binary-Solid Liquid Fluidized Beds

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Keywords : Binary-Solid Liquid Fluidization, Size Distribution, Volume Fraction, Mixed Layer

Abstract

The present paper deals with the liquid fluidization of two different-density species each having a size distribution. A model is developed to predict mean volume fractions of two species in a mixed layer. The predicted and experimental results show that, even in the case that one can calculate the mono-component bed-expansion characteristics of each species without considering a size distribution, change in the bulk composition causes difference in volume fractions at an identical velocity. It is also shown that this difference occurs above the velocity at which the complete mixing of the bed is observed and that the size distribution of the heavier species has a greater effect than that of the lighter one.

Third International Heat Pipe Simposium, September 12-14, 1988 at Tsukuba, Japan

Frequency Heat Transfer Characteristics of Heat Pipes

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Dynamic models of a heat pipe have been investigated from the viewpoint of frequency characteristics. Thermal responses were measured for a typical heat pipe, for when thermal inputs of several types were applied. For the experimental data of step responses it was shown that the parallel model, which was the combination of two models of first-order with time delay system, were agreement well with experiments. The frequency heat transfer characteristics of the heat pipe were represented by Bode-diagram by manipulat-

ing the experimental results for frequency response, extended frequency response and M sequence signal response by Fourier transform. And for the thermal response to random wave input, some investigations were achieved by comparison between experimental and predicted results.

2nd International Symposium on Cold Regions Heat Transfer, June 28-30, 1989, Hokkaido University, Sapporo, Japan

Experiments And Calculation for Ground Heat Extraction and Storage with a Heat Pump

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Summary

The amount of heat extracted and stored, and soil temperature were studied through experiments and calculations to obtain the ground thermal performance in a ground coupled heat pump with a vertical concentric pipe. Experiments were conducted on long term ground heat storage and extraction, using a vertical pipe buried in the ground. Seasonal changes in the amount of heat storage and extracted, and the soil temperature were measure using glycol solution kept at a specific temperature. Numerical calucula-tions, using a model of a three dimensional finite difference equation, were carried out to analyze and compare the results of the calculations and the experiments. On the continuous experiment the heat extraction rate was approximately 105 W, which was smaller than a result of theoretical calculations. On the repetition experiment the rates of heat stored and extracted were about 407 W and 174 W, respectively, which were in accord with results of theoretical calculations.

4th US Mine Ventilation Symposium, University of California, Berkeley, California, USA.
June 5-7, 1989

The Relation Between the Characteristic Curves of Methane Concentration Changes in Coal Seam Gate Roads and Geological Conditions of Surrounding Coal Seams

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Summary

In Japanese coal mines, drivage works of in-seam gate roads are mainly carried out by blasting methods.

Changes of methane concentration in gate roads are recorded by centralized monitoring systems in general.

To obtain useful information from the recorded data, authors analyzed changes of methane concentration for 3 hours after blastings. As a result, the changes of methane concentration with time can be divided into five distinct patterns. It is thought that appearance of the each pattern depends upon the geological conditions of the surrounding of the headings.

Therefore, we attempted to confirm such observations by simulations using mathematical models. From the results of simulations, it can be reconfirmed that the shape of methane flow rate curves is closely connected with geological conditions in the coal seams.

The 9th International Acoustic Emission Symposium, Kobe, Japan, Nov. 14-17, 1988

The Observation of Landslide by the Acoustic Emission Monitoring Rod

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In this research, the acoustic emission monitoring rod has been developed and was applied to the landslide monitorings practically . As these results, the sliding displacement, the sliding rate and the depth of sliding surface could be measured with high accuracy by analyzing the occurrence frequency of acoustic emissions from the monitoring rod. Actually, the acoustic event rate fluctuated in response to the variation of the groundwater level. From such a relation between cause and effect, it became possible to identify the factor caused the sliding activity. In this respect, the acoustic emission monitoring rod is very practical and useful.

30th U. S. Symposium on rock mechanics, Morgantown WV, June 19-22, 1989

Considerations for Acoustic Emission and Gas Emission in Gas Outburst Processes

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In the early theories on the mechanism of coal and gas outburst, they were broadly classed into those emphasizing either the gas or the stress as the factors of the outburst occurrence. Although the hypotheses on the outburst occurrence mechanism have developed fairly up to date, they are imperfect theoretically and not proved experimentally. In this reason, both the laboratory and field studies have been conducted in order to prove the hypotheses. Practically, acoustic emissions and gas emission in the outburst processes

have been monitored, and the occurrence mechanism of the outburst has been considered on the basis of the monitored results. From these results, it was revealed that the outburst occurrence was dominated by the gas pressure in the cracks developed ahead of the face.

First International Conference on the Metallurgy and Materials Science of Tungsten, Titanium, Rare Earths and Antimony, Changsha, China, Nov. 6-9, 1988

Some Chemical Properties of Collectors to be Used for Selective Flotation of Rare Earth Minerals

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The authors have studied the reactions of the constituent ions of bastnaesite, monazite, fluorite, barite and calcite with various collectors such as alkyl sulfate, alkyl amine, n-acylamino carboxylic acids, etc. Solubility products of precipitates formed from the collectors and the constituent ions of the above mentioned minerals were measured. The results indicated that n-oleoylsarcosine possesses an excellent chemical property fitted to a collector for the selective flotation of bastnaesite and monazite. The dissociation constant, solubility, equilibrium constants of acid soap and critical micelle concentration of n-oleoylsarcosine were determined experimentally.

4th U. S. Mine Ventilation Symposium, Berkeley, U. S. A., June 5-7 1989

The Application of an Expert System to Control Mine Ventilation at the Taiheiyo Coal Mine Under the Open Sea

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Ken TAKAHASHI
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Macroscopic characteristics of a complicated mine ventilation is remarked to build an expert system for mine safety in the Taiheiyo coal mine, Hokkaido, Japan. To gain the characteristics a large number of simulation were performed with varying aerodynamic resistance of the branches with regulator in mine ventilation network. The principal results of the study are as follows,

(1) Pressure loss diagram for ventilation network with main and auxiliary fans enables capability of air circulation in the network.

(2) H-Q (pressure-quantity) diagram gives capacity of air quantity in a network with main and auxiliary fans.

(3) When airflow rate, $Q_{q,i}$ through branch q_i is changed by opening/closing requlator set in the branch, airflow rate, Q_p, through branch p can be represented by the empirical formula.

$$Q_p = \sum_{i=1}^{n} A_{p,i} \cdot Q_{q,i} + Q_{p,o}$$

where $A_{p,i}$ and $Q_{p,o}$ are the constant coefficients.

(4) Macroscopic characteristics mentioned above are available to make rules in an expert system for escaping route at emergency.

Japan - U. S. Cooperative Science Program Seminar on "Solidification Processing of Advanced Materials", OISO, Japan, May 29-June 1, 1989

Promotion Factors on the Transition to the Equiaxed Crystals for Al-Si Alloy Ingot

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To clarify the factors for inducing the transition from columnar to equiaxed zones, the critical fraction solid below which crystals can move with liquid was estimated from several methods. The critical fraction solid in the simulation of pipe formation was changed from 0.10 to 0.40 as columnar zone decreased. On the other hand, the undercooled region was formed in the front of columnar dendrite when the transition occurred in the cylindrical solidification. If the equiaxed crystals are possible to exist in that region, the corresponding fraction solid is in the range of 0.10 to 0.17. Furthermore, the undercooled region was artificially formed by duplex casting and the tranition was forcibly induced. The duplex casting is a method that two molten metals with different solute concentrations are poured with different casting temperatures and time intervals. Then the fraction solid which may exist in the undercooled region is 0.25. Therefore, in order to occur the transition from columnar to equiaxed zones, it is necessary that the undercooled region is formed in the front of columnar dendrites and the quantity of equiaxed crystals coressponding to the fraction solid of 0.10 to 0.25 exist in that zone and they grow, for stopping the columnar growth.

The Second International Symposium on Heat Transfer, Beijing, CHINA, August, 9-11, 1988

Heat and Mass Transfer during Heat Recovery from Flue Gas

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Convective heat transfer and condensational mass transfer were measured at the surface of a water-cooled copper tube bundles situated in a moist air flow with 0-60wt% water vapor content under a condition of filmwise condensation for Reynolds numbers ranging from 2010 to 9000. The following results were obtained.

(1) When the condensation flow rate increases by increasing the water vapor concentration in the main flow from 0 to 60wt%, the convective heat-tranfer coefficient increases by around 4 times and the condensational mass-transfer coefficient increases by 1.5 times.

(2) When the water vapor concentration is increased from 0 to 60wt%, the Nusselt number and the Sherwood number become less dependent on the Reynolds number.

The Second International Symposium on Heat Transfer, Beijing, CHINA, August, 9-11, 1988

Study on Ignition Temperature of Solid Fuels by using Simulated Fuel

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Followings are obtained from the measured results of the ignition temperature of simulated solid fuels by using a newly designed air-flow type thermobalance.
1. The ignition of the combustible mixture of the volatile matter and oxygen plays an important roll on decreasing the ignition temperature of solid fuels. And the oxygen has an optimum value for the ignition in the flowing gas through the fuel layer of solid fuels.
2. The ignition conditions fall within a triangular region on a graph with the excess oxygen ratio as the abscissa, the ignition temperature as the ordinate, and the oxygen concentration as the parameter.

The Second International Symposium on Heat Transfer, Beijing, CHINA, August, 9-11, 1988

Numerical Simulation of Flame Radiation Heat Transfer with the Number Theory Grids and Regular 20-Hedron Cell Method

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The method described in this paper for simulation radiative heat exchange has some

advantages. It is better than the pure Monte Carlo method and some semistochastic method. When the amount of the radiative beams is less, the probability deviation can be greatly reduced with the grids of the number theory, and the radiative beams are well-distributed with the regular 20-hedron cells. Therfore, the calculated result is consistent with the real combustion process. Effort of the authors are being spent to couple the model with the models of the flow process and the reaction process in combustion chambers.

International Symposium on Thermodynamic Analysis and Improvement of Energy Systems, Beijing, CHINA, June 5-8, 1989

Analysis of Leakage Effects on the Performance of Two-Phase Flow Screw Type Expanders

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Abstract

The effect of internal leakage on the efficiency of screw type expanders was investigated. Leakage flow rates through the different paths were determined from a computer program developed to evaluate machine performance. Leakage flow was found to decrease the internal efficiency from around 35% at lower rotor speeds to 20% at higher speeds. Two leakage paths were primarily responsible : direct leakage from the intake to the exhaust, and between working volumes through the clearance region between the blades and the case.

1989 ASHRAE Annual Meeting, Vancouver, CANADA, June 24-28, 1989

Heat and Mass Transfer around One-Row Tube Bank Simulation Containment Fan Cooler under Post-Accident condition in Nuclear Power Plant

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Experimental measurements are compared with theoretical predictions for heat and mass transfer from hot and highly humid air (130°C, 0 to 60wt% of water vapor content) to horizontal cooling tubes (wall temperature is around 40°C), which are simulating the heat -transfer tubes of a containment fan cooler in the postaccident condition of a pressurized water reactor. As the results, (1) heat and mass transfer coefficients are frrmulated for the present experimental conditions ; (2) When the water vapor concentration in the main flow is increased from 0 to 60wt%, the convective and condensational heat and mass transfer coefficients are approximately doubled ; (3) under the condition of condensation, the absolute values of the convective/condensational heat tranfer data are greater/smaller than those estimated by the equations of Rose and Fujii, respectively, though the slope of the equation agrees with that of the measured data.

1989 International Symposium on Cold Regions Heat Transfer, Sapporo, JAPAN, June 28-30, 1989

Improvement of the Seasonal Performance Factor of Variable Compression Heat Pump System for Cold Regions

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The SPF (Seasonal Performance Factor) of a air-to-air and air-to-water heat pump system for the cold region can be improved by incorporating the screw compressor and

expander, of which the extent of the compression is adjustable according to the ambient air temperature and a two-phase flow screw expander. The estimation is done by the simulation program, that is a FORTRAN program to predict the COP (Coefficient of Performance) and SPF by specifing system operating conditions, refrigerant, the type of heat exchanger, heating characteristics of buildings, heating system, the extent of sub-cool and super-heat and others. As for the ambient temperature, the data of meteorolgical report for every three hours were used. The two-phase flow screw type of expander is considered for the simulation, because the expansion through the throttling valve of heatpump can be recovered by replacing the process by an isentropic expansion. The simulation is carried out for various conditions in some cities of Hokkaido, Japan, and the results were sumerized for the daily, monthly, and seasonal bathes. The result of the simulation showed that the SPF of the system, in which the compression ratio of the compressor is adjustable, much improved comparing with the system, in which the compressing ratio is fixed. And the SPF of the heatpump system for heatig of the private house in Sapporo city is more than 3.0 for certain conditions.

6th International Conference on Numerical Methods in Thermal Problems, Swansea, U. K., Swansea, U. K., July 3-7, 1989

Numerical Analysis on Transmittance of Radiative Energy Through Three-dimensional Packed Spheres

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The transmittance of radiative energy thmough a volume of randomly packed spheres is determined by means of a Monte Carlo method. A computer program is developed for the arrangement of equal-diameter spheres in a packed bed with arbitrary packing density. It is disclosed from the results of thermal analysis of radiative transmittance through a parallelepiped bed that : (i) The low packing density layer adjacent to the side walls causes a decrease in the reduction rate of radiative transmittance within the bed beginning at a location one-to two- diameter depth from the surface of the radiation entrance. (ii) The layer contributes to an increase in the radiative transmittance by an order of magnitude for a bed with a 10×10-diameter cross-sectional area perpendicular to the direction of radiative transmittance. The enhancement effect diminishes with an increase in the cross-sectional area.

6th International Conference on Numerical Methods in Thermal Problems, Swansea, U. K., July 3-7, 1989

Numerical Simulation of Radiative Heat Transfer to High Pressure Turbine Nozzle Vanes of Aero-Engines

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Combined radiative and convective heat tranfer is analyzed numerically in the combustion chamber of aero-engines by using the Monte Carlo method to obtain the heat-flux profiles onto the surfaces of high-pressure turbine nozzle vanes and rotor blades. The combustion chamber and the nozzle-vane cascade are supposed to be two- or three-dimensional. The following results are obtained from the analyses : (1) radiative heat flux to the nozzle vanes is around 10% of the convective flux, (2) when the emissivity of the nozzle vane is increased, the radiative heat flux to the pressure side of the nozzle vane is increased, (3) the increase in the flame absorption coefficient has great effect on the increase in the radiative heat fluxes to the nozzle vane and the rotor blade, (4) three-dimensional analyses are necessary to obtain the above-mentioned quantitative results.

6th International Conference on Numerical Methods in Thermal Problems, Swansea, U. K., July 3-7, 1989

Radiative Heat Transfer Analysis of Indoor Thermal Environment

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This paper describes the numerical method of radiant environment analysis in a complicated enclosure containing human bodies and furniture. An arbitrary configuration expressed in the three-dimensional coordinate system can be treated by this method. A unique space index and another surface index are proposed to specify the geometry of solid

body and surface in the enclosure. The Monte Carlo method is used to determine direct interchange areas, which are then transformed into total exchange areas using the zone method. Energy balance equations accounting for thermal radiation, convection, wall conduction and air ventilation are then formulated for each solid surface segment in the enclosure. A human body model with skin temperatures and clothing is also proposed to simulate its heat release and to predict local thermal sensation around the body. As a practical application, this method is applied to the analysis of the radiant environment in a floor-heated meeting room with eight persons seated around a table.

SAE International Off-Highway & Powerplant Congress & Exposition, Milwaukee, Wisconsin, September 12-15, 1988

Catalytic Effects of Metallic Fuel Additives on Oxidation Characteristics of Trapped Diesel Soot

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The oxidation of trapped diesel soots containing catalytic metals such as Ca, Ba, Fe, or Ni were characterized through thermogravimetric analysis with a themobalance. Soot particles were generated by a single cylinder IDI diesel engine with metallic fuel additives. A two-stage oxidation process was observed with the metal-containing soots. It was found that the first-stage oxidation is catalytically promoted by metal additives resulting in an enhanced reaction rate and a reduced activation energy. Soot reduction in the rapid first stage increases with increases in metal content. Soots containing Ba and Ca are oxidized most rapidly due to the larger reduction during the first stage. The second stage of oxidized also slightly promoted by metal addition. The ignition temperature of the collected soot is substantially reduced by the metal additives.

8th International Symposium on Alcohol Fuels Tokyo, Japan, November 13 -15, 1988

Methanol Ignition Stabilization with Different Metals in the Combustion Chamber Wall of Diesel Engines

Zhixin HOU, Hideyuki OGAWA, Takemi CHIKAHISA
Noboru MIYAMOTO, Tadashi MURAYAMA

Ignition Stabilization is a concern with alcohol fuels in diesel engines. This paper investigates methanol ignition behavior with different metals in the combustion chamber wall, and determines a way of methanol ignition stabilization. The results indicate only slight improvements in methanol ignition with even the most effective metal in the combustion chamber wall.

Among the metals tested, iron is the most effective in improving methanol ignition. Ignition is affected more in IDI engines than in DI engines, as well as in combustion systems where more unburnt methanol remains longer. The in-chamber concentration of formaldehyde, an intermediate product of methanol combustion, appears to be an important determinant for methanol ignition. To achieve smooth ignition without misfiring, a specific formaldehyde concentration is necessary immediately prior to methanol injection in the combustion chamber.

ISAF-VIII 8th International Symposium on Alcohol Fuels, Tokyo, Japan, Nov. 13-16, 1988.

Photochemical Reaction Process of Methanol Engine Exhaust Gas

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Methanol engines may release new photochemical species. Unburned methanol and NOx react with each other to form methylnitrite. Methylnitrite is oxidized to methylnitrate with UV irradiation. In the conventional photochemical reaction scheme, ozone (O_3) is known to play a significant role in promoting the reactions. It is important to know the role of O_3 to clarify the photochemical reaction process of methanol engine exhaust gases and to establish the global photochemical reaction scheme considering the presence of methanol engine emissions.

In the present work, the formation of O_3 and the effect of O_3 addition to the reaction

system on the photochemical reaction process were investigated. Experiments were performed by a smog chamber surrounded by UV lamps from which emission intensity was identical to sunlight. Experimental parameters were dilution ratio, gas compoenents and irradiation time. The results showed that O_3 was formed in the diluted exhaust gas after starting the irradiation and showed a peak value with progress of the reaction. The effect of O_3 addition clearly appeared on the formation of methylnitrite. The more O_3 addition, the smaller the formation of methylnitrite. However, the rates of methanol consumption and methylnitrate formation were independent of O_3 concentration.

ISAF-Ⅷ 8th International Symposium on Alcohol Fuels, Tokyo, Japan, Nov. 13-16, 1088

Catalytic Combustion of Lean Methanol Mixture for a Room Heater

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Catalytic combustion of lean methanol mixture was investigated to develop a new type of clean room heater. Experimental work and numerical analysis were carried out to evaluate the performance of the catalytic combustors. Experiments were carried out with insulation-type and radiation-type catalytic combustors. In the insulation-type combustor, stable combustion and high combustion efficiency were obtained at a wide range of air ratios. In the radiation-type combustor, some input heat radiated to the surroundings. The catalyst durability was improved in the case of the heat radiation-type combustor. The emission of NOx and unburned methanol were kept at a very low level in all operating conditions. Finally, numerical calculation of axial temperature profiles and reaction regions agreed well with experimental results.

ISAF-Ⅷ 8th International Symposium on Alcohol-Fuels, Tokyo, Japan, Nov. 13-16 1988

The Effect of Water as a Fire Extinguisher on Methanol Pool Burning

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Suppressive effects of water dilution on methanol pool fire were studied. The heat release rate and visible flame height were measured as a function of water concentration of liquid phase under steady conditions. Mothanol aqueous solution containing maximum of 80wt% water was burned in circular combustion vessels of 15.5-60 cm in diameter. Experimental results indicated that, for the pool burning of methanol diluted with water, vaporliquid equilibrium was attained at the liquid surface. At a water concentration of 50wt% and 80wt%, both heat release rate and flame height were approximately 0.8 and 0. 4 times those without water dilution. The minimum water concentration at which extinction occurred was approximately 90wt% irrespective of vessel diameter.

The First KSME-JSME Thermal and Fluids Engineering, Seoul,Korea, Nov. 1 -3, 1988.

Turbulent Structure and Flame Stability of a Diffusion Flame

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The effect of turbulence intensity on the diffusion flame stabilized behind a bluff-body was investigated. A cylindrical bluff-body with fuel injection was placed behind a turbulence generator and the turbulence intensity was controlled by the distance between the turbulence generator and the bluff-body.

Temperature fluctuation was measured in the flame area and the recirculation zone. Based on these results the structure and stabilization mechanism of the flame were discussed. When the turbulence intensity was high, flame structure showed the same

periodicity as the turbulence in the flow field. The flame stability mechanism was also affected by the turbulence intensity. With high turbulence intensity, blow-off occured at a certain flow velocity independent of the amount of fed fuel. From this result, it was concluded that the fluctuation of fluid dynamic characterisatics controlled the blow-off limit of the flame, when the turbulence intensity was high.

The First KSME-JSME Thermal and Fluids Engineering, Seoul, Korea, Nov. 1-3, 1988.

Stabilization of Premixed Double Concentric Jets Flame with Swirl Flow

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Stability limits and structure of double concentric jets flame with a swirl flow were investigated. Special focus was on the structure and the behavior of the recirculation zone formed behind the burner rim or swirler because the recirculation zone plays an important roles in the flame stabilization mechanism.

The change of flame stability limits and shape of flame against the swirl number were examined. The distributions of temperature, gas components, and ion current were measured. The residence time of combustion gas in the recirculation zone was also determined to calculate the mass exchange velocity which is directly related to the flame stability.

From those results it was concluded that

1. Flame stability limits and the shape of flame were strongly affected by the swirl number, S. Flame stability became fairly high and recirculation zone was much extended with increase in swisl number, when $S>0.4$.
2. When the swirl number was very large ($S = 0.71$), the total mass exchange of recirculation zone was 10~20 times larger and the mass exchange velocity per unit mass exchange area was about three times larger than that for $S = 0$.

ISAF-Ⅷ 8th International Symposium on Alcohol Fuels, Tokyo, Japan, Nov. 13-16, 1988.

Catalytic Oxidation of Unburned Methanol from Methanol Fueled Engines under Un-Steady Operating Condition

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Methanol oxidation reaction on a Pt catalyst was carried out to investigate the catalyst performance for unsteady-state engine operation. The experimental parameters are the gas temperature, gas components, and the catalyst temperature. In the experiments, methanol oxidation ratio and formaldehyde formation were determined with varying temperature and gas components against time. In the case of the N_2-O_2-CH_3OH system, methanol oxidation was completed at a very low temperature and the effect of temperature change was insignificant. However, once other components, NO, NO_2, and CO, were present in that system, the temperature change strongly affected the methanol oxidation process. When the gas temperature rose rapidly, the methanol oxidation ratio lowered and formaldehyde formation rose until it approached steady state. When the temperature was lowered rapidly, the increase of formaldehyde formation reappeared. The effect of changes in NO, NO_2, CO concentrations were also examined. When concentrations of them were rapidly changed, methanol oxidation lowered just after the change of concentrations. These results mean that the methanol oxidation ratio and formaldehyde formation during transient time are different from steady-state operation.

Ⅷ International Symposium on Alcohol Fuels Nov. 13-16, 1988 Tokyo

Potential and Problems in Alcohol Fuel Combustion Techniques in Diesel Engines

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1. Abstract

This report discusses the combustion characteristics and performance of small alcohol fueled diesel engines operated with several kinds of combustion techniques. The authors have investigated the use of alcohol fuels in diesel engines for a number of years, and this

report summarizes the investigations (1)–(8). It evaluates the potential of each method and the problem areas identified in the experiments.

The combustion techniques discussed in the paper include blended fuels, forced ignition, and dual fuel use. Depending on the purpose and conditions of use, all of the methods have potential for good combustion and emissions. Development of a simple pilot injection system and further study of optimum plug locations are necessary for extending the practical applications.

Proceedings 18th International Congress on Combustion Engines 5-8 June 1989
TIANJIN CHINA

Reduction of Smoke and NOx Emissions by Active Turbulence Generated in the Late Combustion Stage In D. I. Diesel Engines

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China Lecturer Zhen Jiang Shipbuilding Inst.

Abstract

The purpose of this study is to achieve simultaneous reduction in smoke and NOx emitted from diesel engines. Generally, there is a trade-off between smoke and NOx emissions, and a simultaneous reduction in both is difficult to realize.

Generating strong turbulence late in the combustion period was attempted, to enhance smoke oxidation without disturbing the initial combustion stage where NOx formation is dominant. The turbulence was generated by jets of burned gas from an auxiliary chamber installed in a direct injection diesel engine. For the reduction of NOx, exhaust gas recirculation (EGR) was combined with the strong turbulence in the combustion chamber at a slightly retarded fuel injection timing.

The experiments were very successful to reduce particularly smoke, and also NOx. Thermal efficiency was improved at full loads. The paper describes the effect for various operating conditions and combustion chamber configurations.

9th International Symposium for Electro-Machining, Nagoya, 11-13 April 1989

Pit Growth During Electrochemical Tunnel Etching of Aluminum

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The effects of process variables on the tunnel growth of pits formed on aluminum during DC etching in hot HCl solutions were studied by SEM observation of oxide replicas. The tunnel growth progressed auto-catalytically, independent of both the pH and the chloride ion concentration of a bulk solution. Tunnel widths increased continuously during etching. Tunnel lengths initially increased at a constant rate, and then the growth stopped abruptly at a limiting length, which was dependent on temperature and nominal current density.

1988 IEEE Industry Applications Society Annual Meeting, Pittsburgh, U. S. A., October 2-7, 1988

Current Source Rectifier/Inverter System with Sinusoidal Currents

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This paper describes a sinusoidal pulse-width-modulation (PWM) method for a current source rectifier and inverter. As a dc current path must exist for current source circuits, the well-known subharmonic method, in which the PWM pulse pattern is produced by comparing a triangular carrier wave to a sinusoidal signal wave, is not acceptable.

First, the instantaneous space vector representation of each phase currents is employed. A performance function (PF), which takes account of L-C filter characteristics inserted in ac lines, is introduced. Then a performance index (PI) which is proportional to the distortion factor of PF is defined. An optimal PWM pulse pattern can be obtained mathematically by minimizing PI. Finally, the method is implemented using two microprocessors, and is applied to an induction motor drive system. Basic performance of the

rectifier/inverter system is demonstrated.

IEEE 1988 Industry Applications Society Annual Meeting, Pittsburgh, U. S. A., October 2-7, 1988

High Performance Operation Scheme for Variable Speed Self-Controlled Synchronous Motor Drives

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One of the remarkable features of self-controlled synchronous motors (SCSM) is its self-commutation capability. This makes possible to use general purpose thyristors without any auxiliary commutation components.

This paper describes a high performance operation strategy for SCSM. With that strategy the power factor of the AC mains and motor is improved, and the torque ripples of the motor are minimized. For a high performance operation, it is crucial to operate SCSM with a minimum essential value of the lead-angle. For that purpose, a scheme called "Constant Margin of Lead-Angle Cotrol", is proposed here, where a minimum essential lead-angle is determined by considering the effects of the armature resistance and thyristor turn-off time on the commutation. Finally the scheme is implemented and its validity is confirmed by experimental results.

IEEE Industrial Electronics Society IECON'89, Singapore, October 24-28, 1988

Sinusoidal PWM Control Method Using a Single-Chip Microprocessor

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This paper describes a single-chip microprocessor-based PWM technique for sinusoidal voltage source inverters. The proposed scheme is considered as a digital alternative of the conventional analog subharmonic method (SHM) in the sense that

1) the configuration of a PWM controller is quite simple,
2) on-line real-time PWM control is possible,
3) synchronization between carrier wave and signal wave is unnecessary, and

4) low-order harmonics in the output voltage are well-suppressed.

Furthermore, the scheme has features that the maximum output voltage is 15% higher than the one obtained by SHM, and the PWM pulse pattern creation principle is applicable to voltage source inverters as well as current source inverters. Experiment is carried out using I80196 CPU. The results demonstrate the validity of the proposed scheme.

International Conference on Power Conversion and Intelligent Motion PCIM'88, Tokyo, Japan, December 8-10, 1988

Basic Characteristics of Active Power Filter Using Current Source Inverter

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An active power filter (AF) generates compensation currents which are equal in magnitude but opposite in phase to harmonic currents in power lines. So far literatures on AF using voltage-source converter (VSC) have been reported. However since AF performs as a current-source, using current-source converter (CSC) is a straight forward way and that facilitates control hardware as well as software. One of the reasons which retards the development of AF using CSC is that PWM thechniques for CSC are rather difficult compared to VSC counterparts. In this paper,

1. a novel PWM techique suitable for CSC is proposed,
2. its input-to-output transfer characteristic is discussed and evaluated,
3. AF design criteria based on the transfer characteristic is offered, and finally
4. the basic performance of AF is demonstrated by the experiment.

IEEE/PES 1988 Summer Meeting, Portland, U. S. A., July 24-29, 1988

Analysis of the Steady State Characteristics of Doubly Fed Synchronous Machines

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This paper presents a theoretical and an experimental analysis of the steady state characteristics of a Doubly Fed Synchronous Machine (DFSM). The basic equations and the equivalent circuit which represent the steady state of DFSM are derived. On the basis of these theoretical results and additional experimental results, the basic characteristics of DFSM are discussed in detail.

CSEE Symposium on Engineering Mathematics and Application, Beijing, China, July 25-30, 1988

A Graph Theoretic Approach to Determine Multiple Bad Data Identifiability in Power System State Estimation

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In this article, attention is directed toward the identifiability of multiple bad data in power system state estimation. Based upon the mathematical description of system observability, bad data detectability and identifiability, concepts of "linear dependence of redundant measurement" and "set of unidentifiable measurements" are introduced, and the topological properties of the latter are derived, which reveal that there exists a dual relation between these two concepts just like circuit and cut set in graph theory. This forms the basis of an algorithm which determines whether such a set exists for multiple bad data. If so, it makes clear why identification fails and points out the weak points in the measuring system. The main idea of the algorithm is described, and some test results are reported too.

13th International Symposium on Mathematical Programming, Tokyo, Japan, Aug. 29-Sep. 2, 1988

Optimal Scheduling in Hydrothermal Power Systems Based on the Lagrangian Relaxation

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A new technique for solving hydrothermal scheduling problems is proposed by means of the Lagrangian relaxation method. Optimal scheduling of the hydrothermal systems is to decide both of unit commitment for thermal units and output power of hydro units, so as to minimize the total operating cost over a future time period. Although several mathematical methods enable the problem to be solved satisfactorily from the theoretical viewpoint, they become rapidly impracticable when the size of the system increases. In this paper an efficient algorithm is developed, where the problem is separated into the following two subproblems ; (1) economic dispatch of power outputs from hydro and thermal units, (2) unit commitment for thermal units. The Lagrangian relaxation method is applied to solve the second subproblem, where the power outputs from hydro units are fixed. Simulations using a typical system model were carried out to confirm the performance of the technique proposed here.

14th Annual Conference of IEEE Industrial Electronics Society, Singapore, October 25-27, 1988

Optimal Generation Expansion Planning with Electric Energy Storage Systems

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This paper presents an efficient method which provides the optimal generation mix and the optimal addition (development) process for not only generators but also for electric energy storage systems. The approximations method, in which the dynamic programming and the gradient method are combined, is developed to determine the optimal generation

mix with energy storage systems. The dynamic programming, in which the stages are time periods and the state is cumulative capacity, is applied to determine the optimal generation addition process. The feasibility of the proposed method is demonstrated on a typical power system model.

1988 KIEE Annual Conf. International Sessions on Power Systems and Apparatus Optics and Quantum Devices, Seoul, Korea, November 25-26, 1988

On-line P-Q Decoupled Preventive Control Strategy for ISMAC (Integrated Security Monitoring and Control) System

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This paper presents an efficient method for static preventive control, which deals with deviations from constraints in a steady state after the clearance of faults, in power systems. The problem to determine the most effective preventive control strategy can be regarded as an augmented optimal power flow problem, which includes the contingency case. One method based on P-Q decoupled model, which is suitable for the on-line use., has been proposed. However it does not consider the P-problem. It is worthless to determine the preventive control actions without considering the operating cost, because the outages to be accounted in the preventive conrtol do not occur so frequently. The global control strategy presented in this paper considers the operating cost in the P-problem and transmission losses in the Q-problem. Numerical examples prove the adequacy of this strategy.

GD88 International Conference on Gas Discharge and Their Applications, Venezia, 19 - 23. September, 1988

Fluorescence from Excimers in Discharges Between needle-needle electrodes

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The relation between the intensity of fluorescence from excimers in intermittent discharges between the needle-needle electrodes to which DC voltage was applied and the repetition frequency of the emission was reported. The result suggested a possibility of high repetition laser oscillation using this electrode arrangement.

International Workshop on Liquid State Electronics, West Berlin, 7-10. November, 1988

Electron self-trapping in liquid neon

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Theoretical models of electron localization predict that the stable state in liquid neon consists of an electron bubble as in liquid helium. Earlier mobility measurements seemed to corroborate these electrons. In solid neon quasi-free electrons have been observed. We repeated mobility measurements of electrons in liquid neon and found that the current signal consisted of two components, a fast one and a slow one. While the slow components gave values of the mobility as reported before, the fast component depended in a peculiar way on the applied field strength. We interpret these observations as being due to quasi -free electrons which are injected initially and which then become localized in an electron

bubble. This process take place in the nono-second time domain.

International Workshop on Liquid State Electronics, West Berlin, 7-10. November, 1988

Electron transport properties in liquefied rare gases

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Detailed understanding of the electron transport behavior and the space charge distribution between the electrodes in nonpolar liquids in high electric fields is important from the viewpoint of technology for electrical insulation, high energy particle detector, and so on. This article reports 1) the electron transport properties in liquefied rare gases and in liquid Ar with small additives of CH_4, and the effect of CH_4 on the properties, and 2) the space charge distribution between the electrodes formed due to photoelectron injection from the cathode in liquid Ar for various applied voltages.

Proceeding of the Nato Advanced Study Instiozte "Non Equilibrium Processes in Partially Ionzed Gases" Maratea Italy, 4-17 June 1989

Self-Consintent Monte Carlo Modelling of Non-Equilibrium RF Flasmas in Monosilane

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Abstract

In the present paper, modelling and simulation of reactive rf non-equilibrium plasmas is presented. These plasmas are important for plasma CVD of semiconductor devices and new materials. Under the plasma CVD conditions, electron energy distribution in rf glow

discharges may not be in equilibrium. To get rid of this problem a Monte Carlo method seems to be available. In the present paper, the simulation technique based on Monte Carlo method is developed and the simulation results of rf non-equilibrium plasma in monosilane gas is also presented.

The 4th Joint Magnetism and Magnetic Materials-Intermag Conference, Vancouver, British Columbia, Canada, July 12-15, 1988

Boundary Element Analysis of Axisymmetric Resonant Cavities

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In the electromagnetic fields analysis of axisymmetric modes of axisymmetric resonant cavities, the governing equation is expressed by the axisymmetric Helmholtz equation. Many authors have been analyzing the problems by using domain type numerical methods. On the other hand, boundary element method (BEM), which is one of boundary type numerical methods, has not been applied to analyze the problems because the fundamental solution of the axisymmetric Helmholtz equation is not expressed in a closed form. So far we have been analyzing the axisymmetric Laplace-type equation by using BEM and getting many numerical skills in the computational analysis of the axisymmetric problems. In this paper, two numerical techniques are applied to the analysis of the axisymmetric resonant cavities. One of them is BE analysis by using new expressions of the fundamental solution of the axisymmetric Helmholtz equation with numerical integrations. Since the fundamental solutions can not be evaluated by using usual Gauss-Laguerre Formulas, we use Double Exponential Formulas and obtain numerically converged solutions. The other is the Integral Equation Method in which we use the fundamental solution of the Laplace equation by considering the axisymmetric Helmholtz equation as the axisymmetric Laplace equation with a nonhomogeneous term. We analyze axisymmetric modes of axisymmetric resonant cavities by using these two numerical techniques, obtain the resonant wave numbers with high accuracies and calculate electric and magnetic fields in the resonant cavities. It is shown that we can analyze axisymmetric resonant cavities by using BEM and it is confirmed that these two methods are useful to analyze the problem.

The 4th Joint Magnetism and Magnetic Materials -Intermag Conference, Vancouver, British Columbia, Canada, July 12-15, 1988

Regular Boundary Element Solutions of Transient Convective Diffusion Equation

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Recently it has been getting important to study stabilijy and accuracy of transient solutions to the convective diffusion equation which is known as the governing equation of the traveling magnetic field. That is why there is possibility getting stale solutions to it by using boundary element methods (BEM). In their analysis, however, conventional BEM with either constant or mixed boundary elements has been applied to solve the equation, so that singular integration has been required in evaluating system matrices. Namely, this demands the special care in the computational process around the singular points. In order to avoid such a problem, therefore, regular BEM is introduced into the transient analysis of the convective diffusion equation for large Courant and diffusion numbers in this paper. We deal with a two-dimension model as a simple example in order to study stability and accuracy of transient regular boundary element (R-BE) solutions. It is found that R-BE solutions are unconditionally stable even for the condition that the Courant number>1 and the diffusion number$>1/2$. Furthermore, we can show that transient R -BE solution as well as conventional steady-state BE solutions have second-order accuracy. It is shown that the R-BEM is available for the transient analysis of two-dimension convective diffusion equations.

The 4th Joint Magnetism and Magnetic Materials -Intermag Conference, Vancouver, British Columbia, Canada, July 12-15, 1988

Three-Dimensional Boundary-Element Method for Magnetic Diffusion Model

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In electrical engineering, transient electromagnetic fields (EMF) are the most significant problems, in which there may be, for example, an eddy current problem in electrical machines and magnetic diffusion (MD) or penetration into protective shields of an electrical equipment. Computational analysis for such an EMF problem is giving successful and valuable results. However, three-dimensional (3D) EMF analysis is still very difficult in spite of its significance. The boundary-element method (BEM) based upon the integral equation is widely known to be an effective numerical method for 3D analysis. In this work, the authors develope a 3D BEM for transient (non-sinusoidal) MD problem. For simplicity, a scalar problem in terms of single magnetic field (or magnetic vector potential component) is considered, but there exsists basically no problem for its extension to vecotr fields. The BEM formulation to 3D transient diffusion equation is presented using the time-dependent fundamental solution associated with the adjoint diffusion equation, and semi-analytical integral expressions with respect to time-spatial boundary integration are shown. To a simplified MD model, the method is applied in order to demonstrate the validity of this formulation. Numerical accuracy is investigated for a function of the time increment and boundary mesh size. As a result, it will be seen that the present method is effective and useful to a 3D magnetic diffusion problem as well as shown in 2D model.

International Conference on Computational Engineering Science, Atlanta, Georgia, U. S. A., April 10-14, 1988

Boundary Element Methods in Plasma Science and Engineering

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In this paper, we apply the boundary element method (BEM) to analyze problems in plasma physics and nuclear fusion engineering. First we solve the nonlinear Poisson equation by using the simple iterative scheme in order to study the plasma sheath model in the boundary plasma. Next, in order to determine the plasma-confinement time in the cylindrical plasma, we analyze the time-dependent diffusion equation of plasma by using separation of variables. Thirdly, we solve the nonlinear Grad-Shafranov equation in order to obtain the magnetohydrodynamic equilibria of both toroidal nuclear fusion machines and compact torus plasmas with the fixed boundary. Furthermore, in order to study the magnetic field reconnection, we solve the convective diffusion equation with constant flow velocity in space and have transient numerical solutions for large Courant and diffusion number. Finally, as one of the fundamental plasma waves, we study plasma surface waves in the cylindrical cold plasma with noncircular cross sections under the quasi -electrostatic approximation.

The Second Joint Meeting of ASA and ASJ Sheraton -Waikiki Hotel Honolulu, Hawaii, USA 14-18 November 1988

Analysis of Sound Fields in Rooms by Bergeron's Method

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A treatment of room acoustics as wave field by the analytical method is not easy unless we assume simple geometrical shapes or simple boundary conditions. We introduce a formulation by application of Bergeron's method to room acoustics, which express the

wave field as a spatial distributed electrical circuit corresponding to the equation of sound field. And we investigate the stationary sound pressure distribution and the reverberation time as a results of the transient analysis in a fundamental cubic room model. The results show validity of the formulation and prove a effectiveness for application of this method to room acoustics.

2nd Sapporo International Computer Graphics Symposium Nov. 30- Dec. 2, 1988 at Sapporo, Hokkaido, Japan

Graphical Representation of Polarization Characteristics in Cylindrical Waveguide with Anisotropic Medium

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Recently, by advance of the digital computer, especially of the super computer, simulation techniques have progressed throughout many branches of engineering such as high speed digital technology, in which it is important to analyze the electromagnetic field having complicated boundary and medium conditions in time domain. A numerical data of field distributions itself has many instructive informations. Furthermore, variations of electromagnetic field cannot be observed directly, so an appropriate presentation of the field distribution by the computer graphics gives the rich knowledges. Also the transient analysis of electromagnetic fields not only clarifies the variation of the field in time but also provides information on mechanisms by which the stationary electromagnetic fields are brought about. We simulate fundamental polarization characteristics of a cylindrical waveguide containing anisotrpic dielectric sheet by the Spatial Network Method. The rotation characteristic of the electric field with the tilt angle θ of optical axis is discussed by the various methods of graphic expression.

1989 IEEE Antennas and Propagation Society International Symposium and URSI Radio Science Meeting at Red Lion Inn, San Jose California, USA June 26-30, 1989

Treatment of Vector Potential in a Three-Dimensional Lattice Network of Spatial Network Method

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In the analysis of electromagnetic fields, the vector potential has important roles especially when sources exist. In this paper, we propose the availability of applying the equivalent circuit for electromagnetic field in the Spatial Network Method to the vector potential fields in the three-dimensional space and time domain. The electric vector potential is introduced as the dual quatity of the magnetic vector potential to satisfy the property of the equivalent circuit for the Bergeron's method. The validity of the treatment is shown by computing the rotating magnetic field around the straight line current from the magnetic and electric vector potential.

1989 IEEE Antennas and Propagation Society International Symposium and URSI Radio Science Meeting at Red Lion Inn, San Jose California, USA June 26-30, 1989

Transient Analysis of a Patch Antenna in a Magnetized Plasma by the Spatial Network Method

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In recent years, the electromagnetic analysis of antennas in a magnetized plasma has become more important. In this consideration, near field characteristics are essential because they determine the far field. However, the analysis of an antenna's near field characteristics in a magnetized plasma, which has gyroelectric anisotropy and dispersive

properties, is generally complicated. As it demands the analysis of the electromagnetic fields related to both the magnetized plasma and the antenna in a three-dimensional space and time domain, the numerical method has become indispensable. In this presentation, the near field of the patch antenna in the magnetized plasma is simulated by use of the Spatial Network Method, (SNM), which performs a three-dimensional time domain simulation. The fundamental field characteristics of the antenna's radiation are shown at different time variations on a vector diagram of the electric fields.

First International Conference on InP and Related Compound Semiconductors, March 19-22, 1988, Norman, Oklahoma, USA

Control of Insulator-Semiconductor Interfaces of InP and InGaAs for Surface Passivation and MISFET Fabrication

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Abstract

The present status of the understanding and control of InP and InGaAs insulator -semiconductor (I-S) interfaces is discussed for surface passivation and MISFET fabrication. The electrical and microstructural properties of I-S interfaces are reviewed, and the existing models concerning the origin of interface states are compared. Then, based on the DIGS model by the author's group, control of I-S interface through introduction of two types of interface control layer (ICL) is discussed. One is an anodic native oxide layer, and the other is an MBE-grown ultrathin pseudomorphic Si layer, both combined with a thick photo-CVD insulator. Both ICLs lead to significant improvements in N_{ss}, channel mobility and drain current stability.

The 20th Conference on Solid State Devices and Materials, August 24-26, 1988, Tokyo, Japan

Correlation between Photoluminescence and Surface State Density on GaAs Surfaces Subjected to Various Surface Treatments

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Hirotatsu ISHII and Hideo OHNO
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Relationship between the band edge PL intensity and surface state density was investigated theoretically and experimentally for GaAs surfaces subjected to various surface treatments.

It is shown that increase of PL intensity does not necessarily correspond to reduction of surface state density. A new mechanism based on fixed charge generation and not on N_{ss} reduction is proposed for PL enhancement by photochemical oxidation and by Na_2S deposition. Marked N_{ss} reduction by HCl treatment is also reported.

5th International Conference on Molecular Beam Epitaxy, August 28-September 1, 1988, Sapporo, Japan

Absence of Growth Sequence Dependence of AlAs/GaAs Heterojuncition Band Discontinuity Determined by X-Ray Photoelectron Spectroscopy

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Systematic in-situ XPS measurements on molecular beam epitaxially grown AlAs/GaAs (AlAs grown on GaAs) and reversed GaAs/AlAs heterojunctions have revealed that the growth sequence of the dependence of the heterojunction valence band discontinuity.

E_v is a measurement artifact. This artifact arises from the strong surface band bending caused by the heavy doping. By reduction of doping, thereby reducing. The effect of band bending, commutativity (i.e. no growth sequence dependence) of E_v in the GaAs-AlAs system is shown to be satisfied within the experimental error.

5th International Conference on Molecular Beam Epitaxy, August 28-September 1, 1988, Sapporo, Japan

Effect of Exposure to Group III Alkyls on Compound Semiconductor Surfaces Observed by X-Ray Photoelectron Spectroscopy

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Clean surfaces of GaAs and InAs prepared by molecular beam epitaxy have been exposed to trimethylgallium and diethylgalliumchloride at various temperatures and the resultant change has been observed in situ by X-ray photoelectron spectroscopy. Saturation of amount of Ga deposited into the surface to about 1 monolayer has been observed at substrate temperature above 320°C, which results in atomic layer epitaxy. No appreciable increase of carbon nor chloride has been observed after exposure to group III alkyls.

16th Annual PCSI Conference February 7-9, 1989, Boseman Montana, USA

Control of Compound Semiconductor-Insulator Interfaces by on Ultra-thin MBE-Si Layer

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Based on the disorder induced gap state (DIGS) model, an attempt is made to control the insulator-semiconductor (I-S) interfaces of GaAs and $In_{0.53}$ $Ga_{0.47}$ As by an ultra-thin surface-oxidized silicon (Si) interface control layer (ICL). A Si ICL is grown on GaAs or InGaAs by molecular beam epitaxy, and is partially oxidized. Then, a thick SiO_2 or Si_3 N_4 layer is deposited by in-situ photo-CVD processes.

An in-situ XPS analysis confirms formation of the intended structures. In the GaAs structure, the state density in the midgap region is remarkably reduced. However, the interface Fermi level is blocked by a high density of interface states near the conduction band minimum, contrary to the recent reports of "complete unpinning". These states are Si-derived intrinsic states, judging from the band line-up. On the other hand, no such states exist in the InGaAs structure and completely "unpinned" behavior with a very small hysteresis is realized after annealing. The result is interpreted in terms of successful pseudomorphic matching of Si ICL to InGaAs combined with excellent I-S matching between Si ICL and SiO_2.

2th International Conference on Formation of Semiconductor Interfaces, November 8-12, 1988 Takarazuka, Japan

X-ray Photoelectron spectroscopy analysis of InP Insulator-Semiconductor Structures Prepared by Anodic Oxidation

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An X-ray photoelectron spectroscopy (XPS) analysis is applied to clarify the composition of the InP insulator-semiconductor structures prepared by the anodic oxidation process. The structures investigated include (i) anodicoxide/InP structure, (ii) Al_2O_3/native oxide/InP structure and (iii) photo-CVD SiN/native oxide/InP structure.

It is shown that the condensed indium phosphate plays an important role in structures (i) and (ii). The composition control of the phosphate layer by anodization is demonstrated, and it is explained by a simple mechanism of field driven movement of indium species. Correlation between phoshate composition and interface state density is found in the structure (iii).

2th International Conference on Formation of Semiconductor Interfaces, November 8-12, 1988 Takarazuka, Japan

Origin and Properties of Interface States at Insulator-Semiconductor and Semiconductor-Semiconductor Interfaces of Compound Semiconductors

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Electrical characterization reveals several salient common electronic features of insulator-semiconductor (I-S) and semiconductor-semiconductor (S-S) interfaces. Currently available models on the origin of states (defect model, DIGS model, effective workfunction model) are compared in their capabilities of explaining these features. The DIGS (disorder-induced gap state) model is shown to posses maximum capability and consistency.

Study of the microstructure of interface by cross-sectional TEM and RBS techniques revealed a strong correlation between lattice disorder and interface state density, and supports the DIGS model.

2th International Conference on Formation of Semiconductor Interfaces, November 8-12, 1988 Takarazuka, Japan

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A Computer Simulation of Recombination Process at Compound Semiconductor Surfaces and Heterointerfaces

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The complex recombination process through quantum states at compound semiconductor surfaces and heterointerfaces is analyzed in a unified manner on computer, using the unified disorder induced gap state (DIGS) model.

Recombination through uniformly distributed states at surfaces and hetero-interfaces, and that through U-shaped surface state at GaAs surfaces subjected to various surface treatments, are specifically analyzed. The result indicates that the effective surface recombination velocity is not constant, but is strongly dependent on excitation intensity and the location of charge neutrality level, E_{HO}. PL intensity enhancement after photochemical oxidation in water and sulfur treatments (Na_2S, $(NH_4)_2S$) is shown to be not due to reduction of surface states, but due to generation of fixed charge, whereas photochemical HCl treatments reduces surfaces states significantly.

Annual Meeting of Classification Society of North America, June 16-18, 1988 New York

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Mulidimensional scaling for asymmetric dissimilarities using Randers metric function in Minkowski space

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The purpose of this paper is to perform Multidimensional Scaling (MDS) for asymmetric dissimilarities using an asymmetrical metric function in Minkowski space. The

first author has been discussed the two-dimensional case, in the previous paper, where a general class of asymmetrical metric functions has been treated. In the method of MDS, however, it is important to know the intrinsic dimensions of the configuration space which represents the dissimilarities. Then, in this paper, as a multidimensional model of the asymmetrical metric function, the Randers metric function is discussed. A method of MDS using this metric function and its algorithm are proposed.

International Computer Symposium, 1988, Tamkang University, Taipei, Taiwan Dec. 15-17, 1988

The Definition and Creation of Terrain Map for Computer Graphics Hologram Source Picture

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This paper presents a method to generate hologram source pictures by CG (Computer Graphics) techniques, where an island model (Rishiri Island of Hokkaido) is chosen and data of terrain map are produced by computer processing. Interpolation of sampling points is done according to the technique invented in this paper, wherer non-fixed subdivision technique is used. Data of terrain height in the newly interpolated sampling points are calculated according to the fractal theory and height data are generated by the polyfunctional Gauss distribution based on the interpolated reference points. The source scenes are rendered using perspective projection and depth-prior algorithm which performs a faster process than the conventional hidden surface removal algorithm. An experiment was conducted by utilizing the method proposed in this paper, resulting in the simulation of a realistic geographical model and production of CG hologram source pictures.

The Third Sino-Japanese Shenyang-Sapporo International Conference on Computer Applications, China, September 6-8, 1988

An Application of a Human Visual System Model to the Block Cosine Transform Coding

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Recently, a lot of image compression techniques have been researched and proposed for the wide needs of using digital images. The block cosine transform coding technique is recognized as the most efficient and effective techniques for obtaining large compression ratios with manageable complexity. But there are less effective quality assessments for those techniques. The mean square error (MSE) measure is the most popular quality assessment. But the visual properties of the human, which is usually the final observer of the image, are not considered in the MSE measure. In this paper, we propose an application of a human visual system (HVS) model weighted MSE measure to the block cosine transform coding technique for the more effective image quality assessment. We then propose an optimum block cosine transform coding technique based on the HVS model weighted MSE measure to obtain higher image quality. Finally, we give some comments on using this technique.

Fourth European Signal Processing Conference, Grenoble, France, September 5-8, 1988

Parallel Processing of ARMA Lattice Identification

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This paper proposes the parallel processing algorithm for adaptive ARMA parameter estimates. The adaptive ARMA parameter estimates demand a large amount of calculation cost. Thus it is difficult to estimate the ARMA parameters of a reference model in real time by using a sequential processor. If a parallel processing technique is introduced into the adaptive algorithm, it may be possible to calculate them in real time. In this paper, the ARMA lattice algorithm is introduced in order to design the parallel processing for the estimates. In some experiments, it is shown that the proposed method can estimate

an accurate ARMA spectrum of the reference waveform.

Fourth European Signal Processing Conference, Grenoble, France, September 5-8, 1988

Speech Input Text Processing Multi-Stage Segmentation and Recovery Method

Kenzi ARAKI, Yoshikazu MIYANAGA and Koji TOCHINAI

This paper proposes a speech recognition method for a Japanese text processing system. In the speech recognition for text processing, we have to deal with several ten-thousands words. However it is still impossible to recognize all of them. In the proposed method, speech signals are recognized as monosyllable strings, and then divided into a set of words. If there are some errors in the recognition, they are corrected during a word determination phase. The proposed method determines correct words from a set of word candidates using the statistics of appearance frequencies for the word candidates. In the experiment for a specific speaker, it is shown that the recognition rates 53.7% and 90.1% can be improved to 79.7% and 97.1% by the proposed method, respectively. In another experiment for an unspecified speaker, it is shown that we can recover recognition errors by using the same method, and that this method is effective for the Japanese speech text processing.

1989 Joint Technical Conference on Dircuits/Systems, Computers and Communications, Sapporo 060, Japan, June 25-26 1989

An Analysis Method of Speech Using a Time-Varying ARMA Lattice Filter

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Abstract

In this report, we propose an estimation method of speech based on an adaptive ARMA lattice modeling. ARMA lattice modelings have the advantages of low calculation cost and the pliancy on estimation orders. But ARMA lattice models have some lattice

parameters in each elementary unit and the sum of the lattice parameters is greater than that of the direct ARMA parameters. Therefore, we design the minimum realization lattice model. In this lattice model, each elementary unit can be represented only one lattice parameter by normalization. In addition, the time varying weighting factor is introduced to the lattice modeling to adapt the time variations of the observed signals. It weights the observed signal and the input signal in a direct manner and can arbitrarily change at any time. Thus this method shows the better traceability for the rapid variation of the signals than the methods with the fixed weighting factor.

1989 Joint Technical Conference on Circuits/Systems, Computers and Communications, Sapporo 060, Japan, June 25-26 1989

An Experimental Consideration on Equivalent Circuit Parameters for Speech Recognition

Masashi TANAKA, Yoshikazu MIYANAGA, and Koji TOCHINAI

Abstract

This report shows an experimental consideration on effectiveness of equivalent circuit parameters in a normalized ARMA lattice model for recognition of phonemes. The equivalent circuit parameters are compared with spectrum envelopes which have widely been employed as characteristics of speech. The spectrum envelopes are obtained form two analysis methods, i. e., the same lattice modeling and LPC.

In the first part of this report, brief explanations of the analysis methods are given. Secondly, a method of recognition, which is a kind of multiple templates methods, and some criteria of evaluation are specified. As conclusions, it turns out that effectiveness of the equivalent circuit parameters were not observed. This is considered to be mainly caused by the low sensitivity of the normalized ARMA lattice model and the concentration of features in some elements. These are expected to be solved by more accurate computation and a new distance measure.

1989 Joint Techinical Conference on Circuits/Systems, Computers and Communications, Sapporo 060, Japan, June 25-26, 1989

An Adaptive System of Multiple Algorithms for Speech Spectrum Estimation

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Abstract

This paper shows that two different kinds of adaptive algorithms should be applied for analyzing voiced and unvoiced speech waveforms. We introduce a modified MRAS for voiced speech, and the MIS for unvoiced speech. In this paper, a new method to separate voiced and unvoiced speech is first ptoposed. From the property of the weighting factor λ which is introduced into MRAS, it is shown that the modified MRAS is suitable for voiced speech. Especially, it is shown that accurate estimate parameters should be selected among the results given by using the modified MRAS. The selection can be performed by using the technique of a neural network. Using above methods, we organized a system which automatically selects an appropriate analysis algorithm, and outputs highly accurate spectra. In some experiments, this paper shows that this proposed system is superior to only MIS, modified MRAS, and LPC at point of estimation accuracy.

1989 Joint Technical Conference on Circuits/Systems, Computers and Communications, Sapporo 060, Japan, June 25-26 1989

An Automatic Hardware Synthesis Method For Parallel Processing Circuits With High Throughput

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Abstract

With the process of LSI design technology and the demand for realizing software level application by hardware, application specific IC_s (ASIC) has been developed. The ASIC is necessary for the hardware of complicated real time signal processing. Since parallel processing methods should be introduced to the algorithms, fully automatic design of the highly parallel processing architectures is required.

In this paper, we propose an automatic hardware synthesis method for specific algorithms. The proposed method designs the data paths of parallel processing circuits with high throughput from an algorithm level description. Algorithms applied to this system are mainly in the area of real time signal processing. These algorithms are described by a modified language to which a time index is introduced. The method designs an architecture which executes the given algorithm with the maximum parallelism and the minimum input interval of pipeline. The results of some design examples show that the method is quite useful for the design of parallel processing circuits.

Second Optoelectronics Conference (OEC '88), Tokyo, Japan, Oct. 2-4, 1988

Symmetry Breaking Instabilities and Bifurcation Phenomena in Dielectric Slab Waveguides Containing Saturable Nonlinear Media

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Much attention has recently been paid to nonlinear guided wave phenomena associated with third-order optical nonlinearity for realizing all-optical functional devices. Among several subjects to be studied, it is of practical importance to identify whether the wave field is stable under specific configuration and/or launching condition.

We attempt in this paper the stability analysis of nonlinear slab-guided waves propagating in saturable nonlinear media. As an intensity dependent variation of the nonlinear permittivity, we consider the two-level type and the exponential type. The former corresponds to a nonlinearity associated with a saturable two-level system, and the latter is simply a convenient mathematical form. At low powers, both of them are virtually reduced to the simple Kerr-law nonlinear model. From numerical results obtained by a self-consistent finite-element technique, we find fascinating nonlinear phenomena in saturable nonlinear guided wave systems.

The 4th Japan-Korea Joint Symposium on Organic Chemistry, July, 1988, Tokyo

"Recent Progress of Organoborane Chemistry in Organic Synthesis" (Invited Lecture)

Akira SUZUKI

The cross-coupling reaction of B-alkyl-9-borabicyclo[3.3.1] nonane (B-R-9-BBN) readily obtainable from alkenes by hydroboration with 1-halo-1-alkenes or haloarenes in the presence of a catalytic amount of $PdCl_2$(dppf) and bases gives the corresponding alkenes and arenes in excellent yields.

1-Ethoxyethyne reacts with B-iodo-9-borabicyclo [3.3.1] nonane (B-I-9-BBN) to give the corresponding cis-adduct which is readily converted into (E)-α, β-unsaturated carboxylic esters and δ-keto esters. Haloboration of propadiene with tribromoborane, followed by the reaction with carbonyl compounds to provide 2-bromo-4-hydroxy-1-alkenes selectively in good yields.

1988 International Symposium on Organic Reactions, Taipei, Republic of China, December 21-23, 1988

New Photoinduced Rearrangements of Steroidal α, β-Unsaturated Cyclic Ketone Oximes Involving an Intramolecular Stereospecific Hydrogen Transfer

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Excitation of (*E*)-1, 4, 4-trimethyl-5α-cholest-1-en-3-one oxime (1) in a protic or an aprotic solvent with a low pressure Hg arc gave rise to (*E*)-1-methylene-4, 4-dimethyl-5α-cholest-1-en-3-one oxime (2) in 69-78% yields whereas excitation of (*E*)-4, 4-dimethyl-5α-cholest-1-en-3-one oxime (3) under the same conditions led to an extensive rearrangement to give 3, 3-dimethyl-4α', 5'-dihydro-A-nor-5α-cholestano[2, 1-c]isoxazole (4). When (*E*)-1-trideuteriomethyl-4, 4-dimethyl-2-deuterio-5α-cholest-1-en-3-one oxime or 2-deuterio-4, 4-dimethyl-5α-cholest-1-en-3-one oxime were subjected to the photolysis, a single trideuteriated oxime or a single monodeuteriated cholestanoisoxazole is obtained. These deuterium labelling studies together with the results of the photolysis of these oximes in CD_3OD proved that the 2α-H or 5α'-H of the photo-products (2) or (4) is stereospecifically and intramolecularly derived from the hydroxyimino proton of oxime (1) or (3). The mechanism of these photorearrangements is discussed.

1988 International Symposium on Organic Reactions, Taipei, Republic of China, December 21-23, 1988

Regio- and Stereoselective Cyclization of Aminyl Radicals Generated by Anodic Oxidation of Lithium Amides of Unsaturated Amines

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Aminyl radicals generated by anodic oxidation of lithium alkenylamides undergo a regio- and stereoselective cyclization to give substituted pyrrolidines in moderate to good yields. For example, an anodic oxidation of lithium *N*-methyl-N-(1-aryl)pent-4-enylamide in THF-HMPA (30 : 1) containing 0.25 M $LiClO_4$ leads to the regio- and stereoselective formation of *cis*-2-aryl-1, 5-dimethylpyrrolidines in 46-52% yields. Simi-

lar oxidation of lithium *N*-methyl-N-(5-phenyl) pent-4-enylamide gives *cis*-2-benzyl-1-methylpyrrolidines in 75-95% yields. Stereochemical aspect of these cyclizations is discussed in conjunction with the related cyclizations initiated by mercury(II) salts. A cyclization of aminyl radicals generated by anodic oxidation of lithium alkynylamides is also reported.

10th AMPERE Summer School and Symposium MAGNETIC RESONANCE AND RELAXATION New Fields and Techniques Ljubljana, Yugoslavia 4-10 September, 1988

Spatial Distribution of Paramagnetic Species Produced by Gamma-Ray in Sulfuric Acid Ices Using ESR Imaging

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The first observation of different density distributions was made between hydrogen (H_t) and deuterium (D_t) trapped in naked frozen sulfuric acid ices irradiated by γ-rays. Unfortunately the So_4 radical distribution could not be observed owing to the nonsimplicity of its resonant line. The novel ESR imaging method above mentioned makes the observation possible.

Second International Symposium on ESR Dosimetry and Applications München/ Neuherberg 10-13 October, 1988

ESR Imaging Investigation on Depth Profiles of Radicals in Organic Solid Dosimetry

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Sapporo 060 Japan

Recently alanine has been investigated to develop a more reliable radiation dosimeter using long term stability of radicals produced by ionization irradiation and its wide dynamic range. Most recently sucrose also has been found available for reliable dosimetry. So far it has been used to determine a radiation dose at a certain location in radiation field as a point. In the present research we have investigated the application of ESR imaging to the alanine, sucrose and other organic solid in order to observe the depth profile of radicals with relation to radiation dose suffered from incident electron beam from an about 3 MeV linear accelerator. The spatial distributions produced in the samples were observed by means of the spectral-spatial two-dimensional ESR imaging method which has recently been devised successfully.

International Symposium on Advanced Nuclear Energy Research -NEAR-FUTURE Chemistry in Nuclear Energy Field-February 15-16, 1989 at the Oh-arai Park Hotel, Oh-arai, Ibaraki, JAPAN

Magnetic Resonance Studies on Cross-Links Produced in Irradiated n-Eicosane as a Model Compound of Polyethylene

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*Faculty of Engineering, Hokkaido University, Sapporo, Japan
**Hokkaido Institute of Technology, Sapporo, Japan
***Research Reactor Institute, Kyoto University, Kumatori, Osaka Prefecture, Japan

Abstract

Normal (n)-eicosane was taken as a model compound for polyethylene. ESR combined with the spin-trapping method was applied to study on radiation effect of γ-ray and neutron beam to the eicosane. Three kinds of radicals, two cross-linked radicals and one precursor radical for cross-link, were identified by ESR. A difference was found in the molecular mobility between the effects of the γ and neutron irradiations. Three kinds of cross-linked eicosane molecules (dimers) were found by ^{13}C-NMR and FE-mass spectroscopy ; one is a saturated dimer, one with one double bond, the others with two double bonds. It was concluded from ^{13}C-NMR that majority of the cross-linked eicosane was of the H-type, in which a cross-links is formed in the central part of the molecules.

The International Symposium on the Radation Chemistry of Polymers March 29 -31, 1989 at the Sanjyou-Kaikan, University of Tokyo, JAPAN

ESR and NMR Studies on Cross-links Produced in γ and Neutron Irradiated n-Eicosane as a Model Compound of Polyethylene

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**Hokkaido Institute of Technology, Sapporo, JAPAN
***Research Reactor Institute, Kyoto University, Kumatori, Osaka-Prefecture, JAPAN

Abstract

Normal (n)-eicosane was taken as a model compound for polyethylene. ESR combined with the spin-trap method was applied to study on radiation effect of γ-ray and neutron beams to eicosane. Three kind of radicals, two cross-linked radicals and one precursor radical for cross-links, were identified by ESR. A difference was found in the molecular mobility between the γ and neutron irradiations. Three kinds of cross-linked eicosane molecules (dimers) were found by mass spectroscopy, one is a satureted dimers, one with one double bond, the other with the two double bonds.

International Symposium on Cooperative Dynamics in Complex Physical Systems, Kyoto, Japan, August 24-27, 1988

Superlocalization of Fractons : Direct Observations by Supercomputer

K. YAKUBO and T. NAKAYAMA
Department of Applied Physics, Hokkaido University
Sapporo 060, Japan

We present the first direct evidence for fracton "superlocalization" excited on two-dimensional percolating networks, using a novel numerical method and array-processing supercomputer. We have observed, from the mode-patterns of fractons, that the geometrical characteristics of percolating networks result in the fracton superlocalization. These indicate that the origin of fracton superlocalization is quite different from the case of the Anderson localization coming from both interference and direnionality. In addition, the frequency dependence of the localization length of fractons is examined.

5th International School on Condensed Matter Physics "Disordered systems and new materials", Varna, Bulgaria, September 19 - 27, 1988

Pressure studies of amorphous semiconductors (invited)

Keiji TANAKA
Department of Applied Physics, Hokkaido University,
Sapporo 060, Japan

Pressure effects on structural and electronic properties in chalcogenide, pnictide and tetrahedral disordered-materials are investigated in order to exploit unified ideas connecting macroscopic characteristics with atomic structures. Phenomena induced by uniaxial compression and squeezing are also discussed.

International Conference on Raman Spectroscopy, Calcutta, India, November 2-6, 1988

Density of States of Fractons in Percolating Networks

T. NAKAYAMA and K. YAKUBO
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Sapporo 060, Japan

The vibrational densities of states of two- and three-dimensional percolating networks are investigated, using a novel numerical method and array-processing supercomputer. The sizes of our networks are over $N > 10^5$, and these large sizes are crucially important for our purpose. It is confirmed that there are two distinct frequency regimes in the density of states characterized by ω_c. In addition, it is found that no notable steepness or hump exists in the phonon-fracton crossover region, in confilict with the prediction of the effective medium theory. We suggest tiat the steepness or hump observed by the Raman scattering has its origin in the vibrational modes attributing to the bond -bending force and has nothing to do with the steepness predicted by the effective-medium theory.

International Conference on Raman Spectroscopy, Calcutta, India, November 2-6, 1988

Superlocalization of Fracton Wave-Functions Excited on Percolating Networks

K. YAKUBO and T. NAKAYAMA
Department of Applied Physics, Hokkaido University,
Sapporo 060, Japan

We have investigated the nature of the localization of fracton excitations using a novel numerical method and array-processing supercomputer. The sizes of our networks are 3×10^5, and these large sizes are crucial in order to obtain correct insight into the nature of superlocalization of fracton. We have observed from the modepatterns of fractons' that the geometrical characteristics of percolating networks result in the fracton superlocalization : that is, a fracton is localized in "penunsula" and the excitations in the penunsulas do not diffuse into the "continent" through the narrow channel.

Topical Meeting on Laser Materials & Laser, Spectroscopy Shanghai, China, July 25-27, 1988

Frequency Stability Measurement of Zeeman Stabilized He-Ne Laser

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Hokkaido University, Sapporo 060 Japan

Frequency fluctuation and drift of commercial stabilized 633 nm He-Ne lasers were measured. The internal mirror type laser is in a transverse magnetic field, which is produced by a pair of permanent magnet bar and the laser radiates a pair of Zeeman split plane polarized components, which are orthogonal each other. Zeeman beat signal produced by the components is detected and converted into an error signal through a frequency-voltage converter and is used to regulate a current for a heater coil, which is wound around the laser tube. We measured two lasers, which has a Zeeman beat of about 563 kHz and 187 kHz respectively.

International Symposium on Large Telescopes '88, JNLT and Related Engineering Developments, Tokyo, Japan, November 29 - December 2, 1988

Spectral Speckle Spectroscopy

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Hokkaido University, Sapporo 060, Japan

A method to realize speckle spectroscopy is presented. This method is based on the shift-and-add procedure. The incident beam is divided into two. One beam is used to form a white light speckle image. The other beam is led to a spectroscopic system and constructs a spectrally dispersed speckle image. Since the two beams have a fixed relationship, each speckle in the white light speckle image corresponds to the dispersed speckle in the other beam. The shift-and-add procedure in the white light speckle image leads to yield diffraction-limited objective prism spectra. Some results of laboratory experiments are shown and confirm the usefulness of the described method.

6th International Symposium on Calcium-Binding Proteins in Health and Disease, Nagoya, Japan, July 24-28, 1988

^{31}P NMR Studies of Myosin Light Chain LC2

Toshifumi HIRAOKI, Osamu MINOWA*, Kunio HIKICHI**, and Koichi YAGI*
Department of Applied Physics, Faculty of Engineering,
*Department of Chemistry and
**Department of Polymer Science, Faculty of Science

Myosin light chain of chicken striated muscle, LC2, binds one Ca (II) /mol protein and the Ca (II)-binding site is inferred to locate in the region of asp-35 to asp-46. The ser-13 of LC2 is phosphorylated by myosin light chain kinase. However, the function of phosphorylation in the striated muscle is unclear at present. We have studied the motional properties of the phosphoserine-13 (p-ser-13) of LC2 by means of ^{31}P NMR. ^{31}P NMR spectra and spin-lattice relaxation times were not changed by the presence or adsence of Ca (II), although the molecule shows a large Ca (II) induced conformational change. The correlation time for the phosphorous group of p-ser-13 is 1.5 ns at 4°C. On the other hand, the correlation time for the over all motion of LC2 is about 100ns. ^{1}H NMR spectra of LC2 gave rather broad signals and were not changed by the pressence or absence of Ca (II), and the phosphorylated or unphosphorylated state. These indicate that the reorientation of the phosphorous group is rather fast compared with the overall motion of the rigid molecules LC2. The addition of heavy meromyosin to LC2 induced the line width of the ^{31}P NMR spectrum broadening slightly. The pKa of p-ser-13 estimated is 6.1 in both the absence and presence of Ca (II). The pKa is very close to the value for the free phosphoserine. It shows that the p-ser-13 exposes to the surface of the molecule. Such a local fast motion of the p-ser-13 facilitates access to the regulatory site by myosin kinase and phosphatase.

IUPAC 32nd International Symposium on Macromolecules Kyoto, Japan, August 1-6, 1988

Effect of the Distribution of Free Volume on the Dielectric Relaxation in Polymers

Yuichi ANADA[1], Meko KAKIZAKI[2] and Teruo HIDESHIMA[2]
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A simple theory is presented to explain the shape change of loss permittivity versus frequency curve due to the micro-Brownian motion of macromolecules in poly (vinylidene fluoride) on the assumptions : (1) there is a spatial distribution of free volume and the observed loss permittivity is a superposition of contributions from various amorphous parts with various free volume fraction ; (2) relaxation time is given by the Doolittle equation.

In addition, the free volume is assumed to obey a Γ-distribution and to be a linear function of temperature. As for the decay function of polarization, an exponential function with a single relaxation time and the Williams-Watts function were used for the sake of comparison.

Experimental results agreed well with the calculated values using the exponential function as well as those using the williams-Watts function. This facts implies that the shape change is caused primary by the distribution of free volume.

4th International Conference on Chitin and Chitosan 22-24 August 1988 Trondheim, Norway

Molecular Motions and Dielectric Relaxations in Chitin, Chitosan and Related Polymers

Maeko KAKIZAKI, Hiromasa YAMAMOTO, Tatsuya OHE and Teruo HIDESHIMA
Department of Applied Physics, Faculty of Engineering
Hokkaido University, Sapporo 060, Japan

Complex permittivity of chitin, chitosan, amylose and dextran in glassy state has been measured in the frequency range from 30Hz to 10 kHz and in the temperature range from ca. −190°C to ca. 100°C. The relaxation spectrum and the activation energy for the relaxation found around −40°C at 10 kHz in chitin, chitosan and amylose are shown to be

the same irrespective of the difference in chemical structure and mode of linkage of the repeating unit. The corresponding relaxation having the same relaxation spectrum is detected also in dextran but its activation energy is some what smaller. It is concluded that the relaxation in these polymers is caused mainly by the same local motion of the main chain and the difference in the activation energy between dextran and the other polymers is equivalent to the activation energy for the rotation of methylol associated with the main chain, which is lacking in dextran.

World Materials Congress, International Conference on Bainite, Chicago, Illinois, USA, 24-30 September 1988

Nucleation and Growth of Bainite Crystals in Cu-Zn-Al alloys

Kazuyoshi TAKEZAWA and Shin'ich SATO

Based upon the following experimental evidences associated with the bainitic transformation in Cu-Zn-Al alloys, the present authors draw a conclusion that the bainite crystal nucleates and grows martensitically with the help of diffusion of solute atoms : (1) The crystallographic natures, such as the crystal structure, habit plane, etc., of bainite and martensite are almost the same. (2) A large amount of shape deformation is accompanied by the bainitic transformation process. (3) The bainite has a disordered 9R structure when e/a is small, but the stability of ordering in the matrix increases with increasing e/a and the 9R bainite becomes ordered as e/a increases. (4) The concentration of solute atoms in the matrix at the tip of bainite differs slightly each other at the compression and tension sides which would be produced by the shear transformation.

15th International Symposium on Gallium Artsenide and Related Compounds September 11-14, 1988 Atlanta, Georgia, USA

Specific lattice sites and displacement of Si atoms heavily implanted into GaAs by ion-channeling method

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and T. SUZUKI
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Abstract

In order to clarify the saturation mechanism of carrier concentration in heavily Si implanted GaAs crystals, we have carried out ion-channeling experiments with special techniques (asymmetry effects and temperature dependence of dechanneling fractions). From the experiment on asymmetry, it is found that the substitutional Si atoms located in Ga sites prevail over those in As sites. Moreover, from the experiment on temperature dependence, the displacement of Si atoms is estimated to be ~ 0.1 Å from the ideal lattice site. Therefore, it is concluded that the displacement of donor atoms is most responsible for the saturation.

15th Symposium on Fusion Technology, Utrecht, Nethelands, 12-23 September, 1988

Comparative Design Study of Super- VS. Normal-Conducting Large Helical System

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H. KANEKO, K. MATSUOKA, T. HINO, M. TAKEO, O. TSUKAMOTO, K. NOTO
T. MUTOH, Y. TAKEIRI, S. KITAGAWA, T. KURODA, M. FUJIWARA
A. IIYOSHI and Large Helical Design Team
Planning Office for Institute of Fusion Plasma Science,
Nagoya University, Nagoya, Japan

The next large helical device planned at a new Institute of fusion Plasma science in Toki City, Japan is studied for the choice of super-conducting (SC) vs. normal-conducting

(NC) magnet system.

As a standard design, 1 = 2/m = 10 Heliotron/Torsatron configurations with major radius of 4 m, magnetic field of 4T are surveyed with regard to 1) the design flexibility for short-pulsed/high-beta experiments, 2) the possibility for long-pulsed experiments, 3) the accessibility to the machine for heating and diagnostics, and 4) the schedule/cost for its construction.

As for SC option, critical design issues are radial-build conception with thermal insulation and mechanical supports, arrangement of heating and diagnostic ports, rapid poloidal field variation scenarios for high-beta experiments, and the possibility of the reduction of construction schedule. A strong emphasis has been put on the steady-state operation with divertor at SC design.

On the other hand, the NC version suffers from start-up scenarios without hard X-ray production, the requirement of big power supply, and difficulties for the future longpulsed experiment. The main character of the NC design is the flexible control of shaping magnetic field, toroidal electric field and leakage magnetic field with 4 pair poloidal field coils.

For both designs, the magnetic field configurations are controlled by changing the current density distribution of one-pair helical field coils to control the clearance between the divertor plasma and the wall, to modify the separatrix layer and to create helical-axis configurations.

After the detailed comparisons with flexibility of experiments, attainment of plasma parameters, requirement of power supply and schedule/cost of both designs, we concluded the SC machine is appropriate for the main device in a new Toki Fusion Institute.

15th Somposium on Fusion TYchnology, Utrecht, Netherlands, 12-23 SYptember, 1988

Thermal Stability of Chromium Carbide Films and the Stability Against Hydrogen Ions

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Fusion first walls receive both high heat flux and high particle flux. In a case that metal first wall is coated by carbon films, the composition change of the film layer and the erosion due to hydrogens thus become problems. In order to clarify the limit of the carbon films, we had heat treatment experiment and hydrogen ion irradiation experiment for carbon coated Inconel 625. The carbon films was prepared by electron beam evaporation and the hydrogen ion irradiation was performed by ECR ion source.

The carbon films on Inconel survived until the heating temperature of 700 C. In this temperature range, the diffusion of Cr into the film layer was observed from the AES

analysis. The XPS analysis showed the formation of chromium carbide. Thus it was presumed that the formation of the chromium carbide lengthened the life of the carbon film layer.

The carbon coated Inconel was exposed to the hydrogen ions with energy of 1.5 keV and fluence of 10^{19}H/cm at room temperature and at 500 C. In room tempreture case, the films was sputtered. At 500 C, the carbon films disappered due to the chemical erosion, probably due to the low content of the chromium carbide in the film layer.

In order to enhance the thermal stability and the stability against plasmas, we actively tried to make Cr-carbide layer on Inconel. First, the chromium was coated and then the carbon coated. The adhesion of this film layer was considerably improved. By the heating experiment, the present double coated sample survived at least up to 800 C. From the AES analysis, it was found that considable content of the chromium carbide was formed. For the sample annealed at 700 C, the erosion due to the hydrogen ion at 500 C was measured. The AES analysis showed that the chromium carbide films was mostly not eroded.

Above experimental results suggest that the active ceramics formation by double layer coatings is effective both to lengthen the life of the coatings and to suppress the chemical erosion.

15th Somposium on Fusion Technology, Utrecht, Netherlands, 12-23 September, 1988

Properties of Carbon Film by RF Plasma and Comparison with Various Carbon Films

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In-situ carbon coating experiments recently have been performed in several fusion devices to reduce the radiation loss due to metal impurities. The properties required for the carbon coatings are homogeneity both of composition and film thickness, low erosion rate due to chemical and physical sputterings and low hydrogen content. In particular, the hydrogen content has to be lower in order to suppress the particle recyclings since the low density operation becomes difficult in carbonized chamber. In addition, the stable carbon films against fusion plasma would be required. In our study, the simulation experiments using RF plasma were performed to obtain the carbon films with lower erosion rate and lower hydrogen content. For this purpose, the plasma parameters and the sample conditions were varied, and then the surface properties such as crystal structure, depth composition profile and hydrogen concentration were characterized. The present results were also compared with the films produced in several fusion devices.

The structure of carbon films depended on the hydrogen concentration, i. e. the

hydrogen concentration of amorphous carbon film was about 30-40% and that of graphite type films was about 10%. The erosion properties by ion bombardment also depend on the film structure. The sputter-etching rate due to ion irradiation for amorphous type carbon film was smaller than that of graphite type carbon film. For hydrogen concentration of amorphous carbon was reduced by hydrogen ion irradiation from 35 to 30%. Then the pulsed carbon coating method, which consists of carbonization discharges and hydrogen discharges, was developed. With scheme of pulsed carbon coating, the film with about 3% hydrogen concentration was obtained.

We so far analyzed the carbon films produced by RG discharge (TEXTOR), DC glow discharge (HELIOTRON-E), ECR discharge (RIKEN) and Electron Beam Evaporation (EBE, Hokkaido Univ.). The properties of present films obtained by RF plasmas were compared with those of those films. In particular, the relation of the hydrogen concentration with the film structure was studied. The film structure was xixture of amorphous and graphite type carbon for RG and ECR discharge, graphite type for EBE and amorphous carbon for HELIOTRON-E, respectively. The structure of the film very depend on the discharge type. The hydrogen content becomes lower as the structure shifts from amorphous carbon to defective graphite. The choices of discharge type and wall condition for the carbon films are important to obtain the desirable discharge shot in fusion devices.

Japan-US Workshop P134 on Evaluation of Graphite as First Wall Material and Development of First Wall Engineering for Next Large Fusion Device, Sapporo, Japan, 6-8 February, 1989

Characterization of Graphite and Modified Materials : Oujgassing and Effective Surface Area

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Abstract

Surface areas and outgassing behaviors of various carbon materials were investigated by using the physisorption of xenon and krypton at 77 K and a thermal desorption spectroscopy (TDS), respectively. The specific surface areas of isotropic graphites varied from 0.4 to 1.5 m^2/g and had a tendency to increase with apparent density. Carbon/carbon composites are similar to isotropic graphites, but bear no relation to the apparent density. Surface area of graphites decreased one order by coating of pyrolytic carbon. The main gases desorbed from graphites were H_2, H_2O, CO, CO_2, CH_4 and other hydrocarbons. Peak temperature of desorbed gases were 150°C, 300°C, 500°C, 700°C and 1000°C. Total

amounts of desorbed gases from isotropic graphites are about 10^{-2} Torr 1/g in terms of nitrogen gas and decreased one order by coating of pyrolytic carbon.

Japan-US Workshop P134 on Evaluation of Graphite as First Wall Material and Development of First Wall Engineering for Next Large Fusion Device, Sapporo, Japan, 6-8 February, 1989

Erosion and Ion Irradiation Experiment : Erosion of Metal Deposited Graphite

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Abstract

Chemical sputtering yields, i. e. methane production yields of a pyrolytic carbon (PyC) coated isotropic graphite and metal deposited isotropic graphites were measured. Methane production yield of PyC coated graphite was almost same as that of uncoated graphite. Depositions of Ti, Cr and Fe on isotropic graphites were carried out by an electron beam evaporation method. The thickness of a metal layer was 20 nm. Ti deposition reduced methane production yield by the factor of about 0.5 and was most effective to decrease the yield among the three metals. Cr and Fe deposited specimens showed about 20% decrease in methane production yield and the temperature at which the yield became maximum shifted to lower temperature than that for uncoated graphite. Thermal desorption experiments showed that metal deposition created a new site, which promotes desorption of hydrogen at lower temperature. The relation between chemical sputtering process and thermal desorption of hydrogen was also discussed.

Japan-US Workshop P134 on Evaluation of Graphite as First Wall Material and Development of First Wall Engineering for Next Large Fusion Device, Sapporo, Japan, 6-8 February, 1989

Impurity Deposition on Graphite Tiles Used in Heliotron-E

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Abstract

Impurities deposited on graphite tiles, which were placed at the divertor region in Heliotron E device, were analyzed after about 1000 main discharge shots and helium glow discharge cleanings with total discharge time of 200 hours. Considerable amounts of metal impurities such as iron, chromium and nickel were detected on the surface of the tiles. In particular, great amount of metal impurities was observed around the anode used for helium glow discharges. For the other surface region, the impurities were deposited along the divertor traces. This result indicates that the impurities are transported along by the divertor magnetic field structure.

International Symposium on Heat Transfer Enhancement and Energy Conservation, Guangzhou (Canton), China, Aug. 2-5, 1988

An Experimental Study of $CaCO_3$ Scaling

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An experimental study was carried out to clarify the fundamental mechanism of scaling, which is deposition of soluble matters in the fluid on solid walls. The deposition of $CaCO_3$ on high temperature surface from carbonate aqueous solution was chosen as a typical example of the problem.

A series of measurements was performed under conditions of turbulent flow in a rectangular channel with a heat transfer surface on one side of it. A microscope was used to observe and to photograph the crystal nucleus formation and its growth process as $CaCO_3$ was deposited on the heat transfer surface. The result indicated that only one type of crystals was formed under conditions of low surface temperature, but three types of crystals each of which having different growth rates existed at conditions of higher surface temperature. The nucleation rate of $CaCO_3$ crystals and its dependency on surface temperature were also evaluated quantitatively by analyzing the photomicrographs.

The Second International Symposium on Heat Transfer Beijing, China, Aug. 9-11, 1988

A Numerical Analysis of Combined Convective Heat Transfer of Liquid Sodium in Downward Crossflow Through Horizontal Tube Banks

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Sapporo, Japan

The heat transfer characteristics of liquid sodium in combined convection for a helical coil heat exchanger of the decay heat removal system is a growing concern in the engineering safety of fast breeder reactors. In a system with liquid sodium, due to its high thermal conductivity, the heat transfer rate by turbulent diffusion is much smaller than that by heat conduction even in a turbulent flow field. In addition, the coolant at a low

velocity is accelerated in the vicinity of tubes due to the effect of natural convection, hence the separation region generated at the rear of tubes becomes very small.

Considering these features, the heat transfer characteristics of combined convection in turbulent liquid sodium can be studied with a practical accuracy by using an inviscid flow model. From this point of view this paper describes the heat transfer characteristics of liquid sodium which flows in combined convection, through three horizontal rows of tubes in the direction of gravity.

The First KSME-JSME Thermal and Fluids Engineering Conference, Seoul, Korea, Nov. 1-3, 1988

A Simulation of One Dimensional Field with Evaporation and Condensation by Direct Simulation Monte Carlo Method

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Sapporo, Japan

Analyses of evaporation and condensation of metals are important issues for the design of separation cell of laser uranium enrichment, the safety assessments of FBR cores, and the design of fusion reactor blankets. The objective of the present study is to clarify the applicability of the direct simulation Monte Carlo method to heat and mass transfer problems accompanied with evaporation and condensation through examination of some basic phenomena in parallel plate systems.

In the problems accompanied with evaporation and condensation of metals, it is confirmed that temperature jumps on the interphase make temperature distributions with a negative gradient in gas phase, and the temperature jump becomes distinguished at evaporation surface as the far-equilibrium state increases. For the system with the same temperature difference between the wall surfaces, it is found that the negative temperature gradient becomes large as β value, which gives the relationship between saturated vapor density and temperature, increases.

The 3rd Internationam Topical Meeting on Nuclear Power Plant Thermal-Hydraulics & Operations, Seoul, Korea, Nov. 14-17, 1988

Combined Convection Heat Transfer of Liquid Sodium Flowing Through Single Horizontal Banks of Tubes in Gravity Direction

K. SUGIYAMA, Y. MA, and R. ISHIGURO
Faculty of Engineering, Hokkaido University
Sapporo, Japan

It is very important to understand the heat transfer characteristics in combined convection of liquid sodium flowing in the direction of gravity across horizontal banks of tubes for designing heat exchangers in the decay heat removal system of fast breeder reactors. The objective of this study is to clarify the fundamental heat transfer characteristics in its system which differ from ordinary fluids by a numerical analysis using a single horizontal row of tubes.

The heat transfer characteristics at large Reynolds numbers are improved when Gr/Re^2 is increased and the improvement rate is enlarged with increase in p/d value. The temperature field at small Reynolds numbers does not exhibit much change even when the Gr/Re^2 value reaches a high value. This means that, in a decay heat removal system at a low velocity, there are possibilities that an improvement in the heat transfer characteristics by combined convection cannot be expected even in a system with a large Grashof number.

The Third International Topical Meeting on Nuclear Power Plant Thermal-Hydraulics & Operations November 14-17, 1988 Seoul, KOREA

Development of a Simulation Program Code for Support of PWR Power Plant Daily-Cycle Load Following Operations

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A simulation program code has been developed in order to support daily-cycle load

following (DCLF) operations of a PWR power plant. This new code is capable of simulating the various modes of control that occur during in DCLF operations. Some special factors were taken into consideration in order to ensure that the code broadly applied, not only for analysis of DCLF operations in response to relatively gradual power changes, but also for simulation studies concerned with rapid power transients. In order to be broadly applicable, various temperature effects on macroscopic nuclear reaction cross sections and thermo-physical properties, and changes in nuclear composition and neutron flux distribution were evaluated with maximun precision, while preventing significant increase in computation time.

The International Conference on Computational Method in Flow Analysis, Okayama, Japan, September 5-8, 1988

A Deformable-Cell Method Used for Incompressible Density Stratified Flows

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It has been recognized that numerical experiments can well support the researches on the flows of rivers or oceans. In the traditional methods, the flow field is discretized on regular grids even if it is surrounded by curved boundaries, free surfaces, or density interfaces. As a result, computation processes become complex, some errors such as pseudo-viscosity or diffusion are caused, and large memory size and much computation time are required. In the method devised here, the flow field is divided into cells which can have arbitrary shapes, and deform in accordance with the curved or moving boundaries. Then, the above problems are avoided, and furthermore, various boundary conditions can be treated in a unified manner. A hydraulic phenomena "salt wedge" at a river mouth is shown to be simulated by this method, in which one- and two-layered regions, a free surface, a density interface, and a shear flow are coexisting.

Corrosion/89, National Association of Corrosion Engineers (U. S. A.), New Orleans, April 17-22, 1989

Whitney Award Lecture-1989 Towards a More Fundamental Understanding of Corrosion Processes

Norio SATO
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A review is given of simple concepts contributing to a better understanding of corrosion fundamentals. Corrosion processes involve not only electrochemical reactions but also acid-base reactions, and it is the acid-base nature which diversifies the corrosion phenomena. Anions either catalyze or inhibit the anodic metal dissolution, and the passivation will result from the hydroxide-catalyzed mechanism of metal dissolution. Corrosion precipitates frequently control the selective mass transport during corrosion. Anion-selective precipitates accelerate and cation-selective precipitates decelerate corrosion propagation. A bipolar precipitate film, if anodically polarized, undergoes deprotonation and turns into a passive film. The electrochemical stability of passivated metals is determined by the electron energy band structure as well as the chemical potential of constituent ions of the passive film. The passive film of n-type semiconducting oxides appears electrochemically more stable than the passive film of p-type semiconducting oxides.

Corrosion/89, National Association of Corrosion Engineers (U. S. A), New Orleans, April 17-22, 1989

Inhibition in the Context of Passivation

Masahiro SEO and Norio SATO
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This article deals with anodic dissolution and passivation of metals in relation to anodic inhibition of metallic corrosion. It is stressed that an adsorption of electrolyte ions on the metal surface plays vital roles in the anodic dissolution and passivation of metals. In particular, it is pointed out that the acid-base nature of metal's surface or metal ions and ligands, is one of the important factors which controls the chemical stability of adsorption

intermediates and metal-hydrated complex ions in solution. Furthermore, the roles of passivators in corrosion inhibition are discussed from the viewpoint of not only adsorption but also the ion-selectivity of corrosion precipitate films.

36th Midwest Solid State Conference, West Lafayette, U. S. A., October 10, 1988

Phonon Focusing of Ballistic and Scattered Phonons in GaAs

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At low temperatures, e. g. liquid He bath, heat propagation can occur by ballistic phonons -quantized elastic waves which travel across macroscopic sized crystals without scattering. The inherent anisotropies in crystal structures lead to an intense channeling of thermal energy along certain crystalline directions. This channeling of phonons emitted by a point source is known as "phonon focusing". The phonon focusing for low frequency (-10^{10} Hz) phonons is well predicted by continuum elasticity theory. An example of phonon focusing in two dimensions is presented and then extended to three dimensions. The experimental techniques used to record an actual image of a phonon focusing pattern are briefly described.

The Third Polith Conference on Surface Physics Zakopane, POLAND November 7-11, 1988

Surface Acoustic Solitons -Quantum Theoretical Approach-

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Since the surface acoustic waves propagate along the solid surface concentrating their energy within about one wavelength from the surface, the lattice anharmonicity is enhanced especially in high frequency region. This anharmonicity will be balanced with the dispersive effects due to the intrinsic or extrinsic origins and consequently we can expect the formation of the surface acoustic solitons of the envelope type.

Even in low frequency region, if there exist some surface structures which give the normal dispersion relation appropriately, we can also anticipate the generation of the surface acoustic soliton of the KdV type due to the balance between those anharmonicity and the dispersion characteristic to such surface structure. In this paper, we show theoretically that the Love waves can support the KdV type acoustic soliton approximately.

Abstract Submitted for the March 1989 Meeting of the American Physical Society, St. Louis, U. S. A., November 30, 1988

Elastic Scattering of High Frequency Phonons in GaAs

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Monte Carlo phonon focusing calculations including elastic scattering confirm that phonons which scatter as many as three times still retain much of the spatial anisotropy associated with ballistic phonon propagation. These calculations are compared to results of phonon imaging experiments in GaAs. This comparison demonstrates the importance of taking into account a dot product between the initial and scattered phonon polarization vectors in the scattering probability expression. Calculations including this product provide better agreement with the experimental data than those assuming an isotropic probability.

IEEE International Workshop on Intelligent Robots and Systems (IROS'88), Tokyo, Oct. 31 - Nov. 2 1988

Robot Trajectory Control by Preview Control and Adaptive Control

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Department of Mechanical Engineering, Kanagawa Univerity

New trajectory planning method taking control ability of designed robot manipulator

control system into consideration is proposed. It is made systematically without trial and error method on the basis of the frequency response of the designed control system. Basic idea is that trackning speed of the robot manipulator decreases at the sharp corner of the given path at speed up at the curve with large radius same as driving a car in order to improve tracking accuracy. The following control methods are applied to path control along with the proposed trajectory planning method. * Preview control utilizing future desired signal * Adaptive control. Future information is shown to be useful in the first method. Adaptive control method is very suitable to apply the variable speed trajectory planning method because each servo system is decoupled by applying adaptive control method. Parallel drive robot manipulator is taken to be our example to show effectiveness of the proposed method combining with two control methods.

The 2nd China-Japan Symposium on Boundary Element Methods, Beijing, China, October 11-15, 1988

Nonlinear Potential Analysis by Improved Volume Integration Procedure for Boundary Element Method

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A new volume integration procedure is proposed in solving numerically the nonlinear potential problems using Boundary Element Method. Three dimensional nonlinear governing equation can be frequently transformed into Poisson equation having a nonlinear nonhomogeneous forcing term. When the weighted volume integration of the nonhomogeneous term is performed in one of the subdivided regions under consideration, the proposed analytical method makes the integration accurate and saving the computing time.

First Joint Japan-US Symposium on Boundary Element Methods, Tokyo, Japan, October 3-6, 1988

The Error Estimation of The Boundary Element Method on the Multi-regional and Non-linear Potential Problems.

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A performance index which takes the role of judging the accuracy of the solution by the Boundary Element Method is proposed. The proposed index is defined as the difference of potential (also Flux) between two interpolated values of the boundary quantity at any point on a boundary element. The effectiveness of the index is examined in a complicated example problem which is governed by 2D-Poisson, 3D-Laplace and 3D-nonlinear Poisson type equation, respectively.

1st European Conference on Applications of Polar Dielectrics/International Symposium on Applications of Ferroelectrics (ECAPD-1/ISAF'88) Zurich, Switzerland, August 29- September 1, 1988

Piezoactive Ferroelectric Polymer Jacketed Optical Fibers for Optical Phase Modulation

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Frequency response characteristics of an all-fiber optical phase modulator utilizing a vinylidene fluoride/trifluoroethylene copolymer jacket were presented. The jacket was melt extruded onto a single-mode optical fiber and made highly piezoactive by radial poling. The optical phase sensitivity was measured in a frequency range of 20Hz to 50MHZ, and was found to be considerably higher than those reported in previous literatures. The sensitivity was calculated by taken into account the geometry and electrome-

chanical properties of the fiber-jacket composite. A qualitative agreement was obtained between analyses and experiments over a wide frequency range.

Second Optoelectronics Conference (OEC'88), Tokyo, Japan, October 2-4, 1988

High-Sensitive Fiber-Optic Phase Modulator Using Piezoelectric Copolymer Coating

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**Department of Electrical Engineering, Hokkaido Institute of Technology, Sapporo 006, Japan

An integrated phase modulator is made by coating single-mode fibers with a radially poled vinylidene fluoride-trifluoroethylene copolymer. The performance of the fiber as an optical phase modulator was demonstrated over a wide frequency range of 20-50MHz. A phase sensitivity of 2.1×10^{-5} rad/(V/m) per meter of fiber is measured in the low-frequency region and 3.5×10^{-6} rad/(V/m) per meter of fiber is measured in the high-frequency region. At frequencies higher than 1MHz, the optical response is dominated by radial resonances of the fiber-jacket composite.

11th International EPR Symposium July 31-August 5, 1988 at Denver, Colorado

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Resolution Enhancement of ESE-Detected ESR Spectra Due to Alkyl Dadicals in Irradiated Solid Alkanes

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The Electron spin echo-detected ESR spectra of alkyl radicals in γ-irradiated solid alkanes were measured at 77K as a function of the time of longitudinal relaxation, t_1. The longitudinal relaxation was mainly caused by the spectral diffusion induced by the modulation of isotropic hyperfine coupling constants. The resolution of the spectra increased with increasing t_1, because spectral diffusion causes the narrowing of each hyperfine line. The observed spectra compared well with the theoretical ESR spectra

calculated by utilizing a spectral diffusion model in which the spectral shape of each hyperfine line at $t_1 = 0$ is equivalent to the distribution of the diffusion time in the spectral space.

International Meeting on Pulse Investigations in Physics, Chemistry and Biology Czerniejewo, Poland, Sept. 12-16, 1988

Ionic Reactions of Polymers in Solution
—Generation and Characterization of Ion Radicals of Polymers—

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Spectroscopic evidence was given by the pulse radiolysis technique with subnanosecond time resolution for the formation of anionic entities from poly(methyl methacrylate), poly(ethyl methacrylate), poly(4-vinylbiphenyl), poly(1-vinylpyrene) in hexamethylphosphorictriamide and 2-methylterahydrofuran solutions and of cationic entities from poly (4-vinylbiphenyl) and poly (1-vinylpyrene) in 1, 2-dichloroethane solution. The general trend in ion formation from polymers in solution is discussed based on the present and the previous data. Anions are those with an excess electron localized in a chromophor side-group of the polymers, while cations are generally in dimeric form with an positive hole and two interacting aromatic side-groups.

International Symposium on the Radiation Chemistry of Polymers, Tokyo, Japan, March 29-31, 1989

Electron Spin Echo Study of Alkyl Radicals in Polyethylene and Related Compounds

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Alkyl radicals generated by gamma-irradiating polyethylene and low-molecular weight alkanes at low temperatures were studied by the electron spin echo technique. Paramagnetic relaxation of the alkyl radicals observed by this technique depends on the radical-radical dipolar interaction as well as their molecular rotation. The analysis of the

dipolar interaction gave an evidence for the pairwise formation of the alkyl radicals in polyethylene with the average separation distance of 2.6 nm between the paired radicals. Relaxation-resolved ESR spectra of alkyl radicals could be obtained by sweeping the static magnetic field during monitoring the spin echo intensity with a fixed interval of exciting and focussing microwave pulses. The relaxation-resolved spectra showed the difference in molecular motion for each radical and provided the means to study the location of the radical along the C-C chain. These electron spin echo data has been discussed in terms of the mechanism of radiation chemical formation of the radicals.

The International Symposium on the Radiation Chemistry of Polymers. March 29-31, 1989, Tokyo, Japan

Structure and Reactivity of PMMA Ion Radicals. An Ab Initio Approach

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Ab initio calculations were carried out on the anion radical of methyl isobutyrate, a model compound of poly (methylmethacrylate) anion. Calculations were also made on the cation radical of methy lisobutyrate for comparison. The results indicated that a strong absorption band at <320 nm and a weak one at 440 nm were attributable to the π-π^* and n-π^* transition of the PMMA anion, respectively. According to the geometrical optimization, the carbonyl group of the anion was bent and the carbonyl oxygen was deviated from the sp^2 plane of the carbonyl carbon. Molecular orbital contour maps suggested that the excess electron was mainly distributed on the carbonyl group of the polymer. The potential curves obtained by the calculation for the O-CH_3 distance of the PMMA anion and cation were discussed in terms of the stability of the PMMA ions in solid and liquid phases.

The 4th Japan-China Bilateral Symposium on Radiation Chemistry, Kyoto, Japan, April 10-15, 1989

Electron Spin Echo and Optical Absorption Studies on Ionic Solvation in Ethanol

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The solvation structure of benzophenone radical anion and the solvated electron in ethanol has been studied by using the low-temperature γ-irradiation technique combined with the optical absorption and electron spin echo measurements. The benzophenone radical anion is coordinated by two ethanol molecules hydrogen-bonded to the out-of-plane p-orbital of carbonyl oxygen. The solvated electron is coordinated by four ethanol molecules in the first solvation shell. The orientation of molecular dipoles is completed by thermal annealing at higher temperature after the irradiation at 77 K. The nature of the absorption spectra of these solvated ionic species is adequately explained by the molecular desciption of the solvation structure.

The 4th Japan-China Bilateral Somposium on Radiation Chemistry. April 10-15, Kyoto, Japan, 1989

A Pulse Radiolysis Study on the Solvation Processes of Benzophenone and Poly (4-Vinylbenzophenone) Anion Radicals

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*Faculty of Engineering, Fukui University

Stepwise solvation, from presolvated state to fully coordinated one, of benzophenone anion by alcohol was confirmed by the analysis of large spectral shifts of the anion observed in pulsed 2-methyltetrahydrofuran (MTHF)/alcohol mixtures containing benzophenone. Kinetic data concerning the anion solvation by various alcohols were discussed in terms of rotational and translational motions of alcohol and/or anion. The similar pulse radiolysis measurements of the mixtures containing poly(4-vinylbenzophenone) demonstrated the polymer effects on the solvation processes of the polymer anions.

10th International Symposium on Biotelemetry, Fayetteville, U. S. A., Jul. 31- Aug. 5, 1988

Respiratory and Cardiac Monitoring of Neonate by Non-contact Optical Technique

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The respiratory and cardiac monitoring of neonates, particularly of premature infants is important in pediatrics and obstetrics. Current techniques require electrodes in contact with the skin. To solve this problem, a technique is developed which enables us to obtain the information of the body surface movement from a remote place without touching the body. A beam of light illuminates the point of measurement on a body surface. The displacement of the body surface in the direction of the light beam moves the point of light on the position sensitive device which converts the movement of the point into the change of electric current. All the measuring devices are placed outside of a transparent incubator of a neonate. In clinical experiments, the chest wall displacement of neonate was recorded with this technique and compared with the respiration curve and ECG obtained with the conventional technique using a monitoring equipment which has been used widely in clinics. The results verified a promising possibility of this technique.

World Congress on Medical Physics and Biomedical Engineering, San Antonio, U. S. A., Aug. 6-12, 1988

Free-space Optical Data-link for Biomedical Telemetry

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A real-time transmission of biomedical signals has an increasing significance in the field of biotelemetry particularly in telemedicine. With a view toward the multi-variable analysis of biological parameters under various environmental conditions, a system was developed which enables us to obtain the information of a patient from a remote place.

The system consists of two stations connected with a free-space optical link. At the data acquisition site, biological signals are obtained, pre-processed by a microcomputer, multiplexed with color images and sounds, and transmitted in a beam of light. At the data -analyzing site, the light is received, and the different kinds of information are retrieved. Using this system, the data obtained at experimental fields or in a remote building can be fed to a large computer in another building which performs the advanced data-processing. The function of an automatic repeat request prevent the data loss in a short time interruption occured in the data-link.

World Congress on Medical Physics and Biomedical Engineering, San Antonio, U. S. A., Aug. 6-12, 1988

Development of Medical Telemeter using Indirect Light Transmission

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There have been some reports on the optical telemeters using a direct light transmission. Although their advantages over the conventional radio telemetry have been verified, its application in practice has been limited due to the problems in maintaining the propagation path of the light. To solve this problem a technique using an indirect light transmission is proposed. The distribution of the indirect light in a room was calculated, and the feasiblity of this technique was examined in various conditions. To verify the possibility shown in the theoretical analysis, an optical telemeter using the indirect light transmission was developed. The signals of 3 ECG's and a body temperature are multiplexed in time domain and modulated into a PIM pulse sequence. With the developed telemeter the optical biotelemetry from a freely moving subject was carried out. A stable data acquisition was demonstrated even from the subject in exercise.

World Congress on Medical Physics and Biomedical Engineering, San Antonio, U. S. A., Aug. 6-12, 1988

Battery-type Sequential Pulse Defibrillator by using a Single Capacitor Bank

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A battery powered sequential pulse defibrillator was designed and tested for the development of implantable sequential pulse defibrillators by modifying the output circuit. Tow GTO thyristors were used as the switching device in the output circuit, and charged energy in a capacitor bank was divided into the first and second pulses sequentially. An electrode catheter which has two glassy carbon electrode elements was introduced through the jugular vein in dogs. The distal and proximal electrodes were located in the right ventricular apex and the superior vena cava. The thresholds of simultaneous-pulse (5 ms) and sequential pulses (5-1-5 ms) defibrillation were 400 V (1.44 J) and 260 V (0.69 J), respectively. The defibrillation energy in our system was 50% less than simultaneous defibrillation.

World Congress on Medical Physics and Biomedical Engineering, San Antonio, U. S. A., Aug. 6-12, 1988

Scanning Electron Microscopic (SEM) Examinations of a Ceramic Prosthetic Heart Valve for Use as a Cardiac Prosthesis

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Fractures and thrombus generation of prosthetic valves have led to a development of a more durable and thrombo-resistant heart walve comprising a single crystal alumina disk and titanium nitride valve ring. Blood compatibility was examined by SEM examina-

tions of the valves implanted in sheep. The ceramic valves were incorporated into a pneumatic assist pump. The pump was paracorporeally implanted between the left atrium and the descending aorta in a sheep. There was little fibrin and few platelet colonies on the alumina disks. There was no gross platelet deposition on the TiN rings, exept for some deposition of fibrin and platelets on limited regions. The adhered platelet number was few and the shape change was mild on both the single crystal alumina disk and TiN valve cage. The ceramic valve is a promising heart valve for cardiac prostheses.

World Congress on Medical Physics and Biomedical Engineering, San Antonio, U. S. A., Aug. 6-12, 1988

Ultrasonic System for Noninvasive Measurement of Regional Elasticity of the Artery

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To measure noninvasively the regional elastic properties of the artery, we have developed an ultrasonic system, which comprises an ultrasonic displacement meter, an echographic equipment and a personal computer. The displacement meter is designed to track pulsatile motion of the anterior and posterior walls of the artery at the proximal and distal sites and also designed to enable us to monitor easily a measured site on the display. From pulsatile diameter change, mean diameter and/or pulse pressure, the pressure strain elastic modulus Ep and regional pulse wave velocity PWV are obtained. Ep and PWV were measured on healthy subjects along the carotid, iliac and femoral arteries and the abdominal aorta. These measurements showed the progressive increase with distance to peripherals. Age-related increase in Ep of the abdominal aorta was also found. The system demonstrates the feasibility of noninvasive detection of atherosclerotic change.

Third International Conference on Engineering Graphics and Descriptive Geometry, Vienna, Austria July 11-16, 1988

Application of Computer Graphics to Several Engineering Problems

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A new research approach, computer graphics and its application to industrial equipment are described in detail. The new proposed method is based on the direct simulation of radiative heat transfer phenomena and uses computer graphics effectively in conjunction with the newly devised analytical method, called the R. H. R. method. The authors are now using the R. H. R. method to solve complex problems such as multi-reflection phenomenon at a diffusive wall or scattering phenomenon of soot particles. As computer graphics is one of the best way of direct communication with the computer, the development of hardware and software for this method is in great demand. Computer graphics is an effective method to solve many problems and is expected to expand the use of computer analyses in engineering and other fields.

Second Conference of the International Federation of Classification Societies, University of Virginia, Virginia, U. S. A., June 27-30, 1989

Data Analysis System with Direct Manipulation

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The efficient manipulations of data analysis systems have begun to arouse considerable attention with the popularization of the systems. The menu method and the command method are ordinary manipulations of them. Another methods are developed with the advance of the study of man-machine interface. One of the most attractive methods is the utilization of graphics, in other words vision. Visual programming environments have been studied in the field of the information engineering.

The conception of the visual programming is applied to the field of the data analysis and we get a view of visual data analysis. The objective of the paper is to visualize the operations of data analysis. We produced a visual data analysis system on a micro.

Symposium on the Effects of Radiation on Materials, Andover, U. S. A., June 27-29, 1988

Effect of Composition and Phase on Segregation of Fe-Cr based Alloys

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For the basis of low activated steels, the compositional changes after electron irradiation have been investigated in ferritic and austenitic Fe-(2-15%) Cr-(0-20%) Mn-X alloys, by means of high voltage electron microscope. In each Fe-Cr-Mn alloy, the most remarkable void formation was observed near 670 K. However, the swelling was reduced in alloys with low Mn and Cr concentrations, or the addition of Al, W and V. On the other hand, only in Fe-2-1/4Cr-V and Fe-9Cr-V alloys small amount of voids were observed but swelling was quite low. Compositional analysis by EDS showed the depletion of Mn and Cr in austenitic alloys and, in ferritic alloys, Cr enrichment at dislocation loops formed during irradiation. A remarkable compositional change in austenitic alloys occurred at the temperature corresponding to that of the swelling maximum. Also, the compositional change was suppressed by the addition of Al, W and V. The behavior of void formation and compositional change are discussed the solute addition.

Symposium on the Effects of Radiation on Materials, Andover, U. S. A., June 27-29, 1988

Microstructure of Neutron Irradiated Vanadium Alloys

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To investigate the effect of alloying elements on void formation and precipitation

during neutron irradiation, V and V based alloys (V-C, V-Cr, V-Ti and V-Mo) were irradiated with experimental fast breeder reactor "JOYO" up to 5×10^{25} n/m^2 at 670-870 K. Alloying elements were selected on the basis of volume size factors ; C is for an interstitial atom, Cr is for an undersized substitutional atom, and Tiand Mo are for oversized ones. Voids were formed in almost alloys, except in V-C and V-Ti alloys. Precipitation was not confirmed in V-Mo alloy, and homogeneous void formation occurred, where the swelling was not so large. On the contrary, V-Cr alloy showed the inhomogeneous void formation, and the swelling was larger comparing with V. This void formation was related to the radiation-induced precipitates which nucleated on pre-exsted dislocations. These behavior of void formation and precipitation are discussed on the basis of alloying effects.

Beijing Tech. Univ. and Hokkaido Univ. 2nd Congress on Metallurgical Engineering, Beijing, China, September 12-13, 1988

Structural Change in Hydrogen implanted Aluminum

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Aluminum thin foils containing dislocations and/or bubbles produced by 25 keV H_2^+ ion implantation in the range of $1-10\times10^{17}$/cm^2 at room temperature were investigated by means of Elastic recoil Detection method (ERD) and Transmission Electron Microscopy (TEM). At fluences less than 1×10^{17}/cm^2, a great number of black dot like dislocations and no bubbles were observed. And at about 2×10^{17}/cm^2, a few bubbles were recognized in connection with line dislocations, but the number density of black dot like dislocations decreased. Moreover, electron irradiation were performed with a focused beam, operated at 175 kV accelerated voltage, around a bubble, then dislocation loop punching from the bubble took place. Further H^+ implantation was performed up to 4×10^{17}/cm^2, then numerous bubbles ranging in diameter from 5 to 100 nm were recognized. When ion dose was greater than 5×10^{17}/cm^2, the Swiss cheese structure, we called, was observed and at the same time, surface blistering occurred.

IEA Workshop on Low Activation Materials for Fusion, UCLA, Los Angeles, U. S. A., February 21-22, 1989

Fundamental Studies on Vanadium Alloys Conducted at Japanese Universities

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Japanese research on vanadium alloys has been organized especially in universities at ten years ago. Main aspects of this project related to develop the vanadium alloys for a low activated materials, and the detailed subjects can be categorized as follows : (1) microstructural change and alloying element effects, (2) strength and embrittlement, (3) coating and diffusion bonding, (4) effects of gaseous element, such as oxygen, hydrogen and helium, and new alloy development, such as fundamental studies and alloy development, V-Cr-Ti, V-Ti-Si and V-Cr-Ti-Y. Each subject has been examined with and without neutron irradiation condition. In this overview, the detailed activities and some comments on future studies will be presented.

Third International Conference on Joining Ceramics, Glass and Metal, Bad Nauheim, FRG, April 26-28, 1989

Reaction Welding of Magnesia to Magnesia Using Nickel-Metal Foil

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The solid welding of magnesia to magnesia with nickel foil were accomplished at 1573 and 1873 K. A nickel-metal foil was placed between two magnesia blocks and this set was annealed in air. Nickel metal entirely reacted with gaseous oxygen into nickelous oxide. Then, joining layer consisted of the magnesia-nickelous oxide solid solution with wholly continuous interfaces.

At 1573 K, recrystallization of the solid solution was not observed. At 1873 K, however, it was crearly observed and new crystal grains were grown.

The fracture strength of joining parts annealed at 1573 K was relatively lower values.

But, at higher temperature annealing, the strength up to 63 MPa was achieved. The strength of magnesia after the annealing at 1873 K for 64 hr was ca. 90 MPa. Thus, the maximum value of the fracture strength by solid welding at 1873 K reached 70% strength of the magnesia sample itself.

This technique will be of great help in forming ceramic products into a complicated or very long shape.

Gordon Research Conference 1988 Fuel Science New Hampton School, N. H., U. S. A. July 4–July 8, 1988

In-situ monitoring of pyrololysis and hydrogenation of heavy hydrocarbons with high-temperature and high pressure NMR and ESR

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Summary

It has been built in-situ high-temperature, pressure NMR and ESR apparatus in Hokkaido University. Pyrolysis and hydrogenation occuring up to 500°C and 100 atm for coal and petroleum resid can be monitored by these techniques. Useful informations are derived with in-situ techniques concerning chemical reactions for coke making, hydroliquefaction of coal, and cracking and hydrotreatment of resid. Overview and prospect on pyrolysis and depolymerization reactions under inert and hydrogen atomospheres has been made in the lecture.

Carbon'88, Newcastle upon
Tyne, UK 18-23 Sept. 1988

Application of Carbon for Column Packing of High Performance Liquid Chromatography

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Summary

Carbon microbeads obtained from n-paraffin and petroleum powder coke were found to have potential to use of column packing for the separation of some useful compounds. Separation capability of carbon for hplc column is closely related to its optically anisotropic texture.

Carbon'88, Newcastle upon
Tyne, UK 18-23 Sept. 1988

Investigation of Mesophase Formation Process using ESR, NMR and DSC

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Summary

The early stage of carbonization of petroleum pitches has been studied by in-situ, high -temperature ^{1}H-NMR and ESR techniques. Well-resolved ^{1}H-NMR spectra were found to provide detailed information about the mesophase formation in the course of pyrolysis. The process of mesophase generation during cooling was clarified by using an ESR spin probe. The nucleation of mesophase embryos in these processes was clearly obsereved in the both spectra. It was found that the mesophase transformation occurs at nearly the same level of aromatic hydrogen fraction or spin concentration.

Proceedings of Asian Conference on Fluidized-Bed and Three-Phase Reactors, Tokyo, JAPAN, December 14-17, 1988

Bed Contraction of Liquid-Fluidised Binary Solid Particles at Complete Mixing

Tadatoshi CHIBA
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Summary

Simple experiments were carried out to confirm a result predicted by our previous unit cell model that liquid-fluidised binary solid particles at their complete mixing state always have a bed height lower than the sum of the individual monocomponent bed heights at the same liquid velocity. Bed expansion data for two size- and density-different solid mixtures were obtained by visual observation in a 50 mm dia. column using ambient-temperature tap water as a fluidising liquid. The experimental results showed that such a bed contraction takes place for the mixtures with the smaller particles having density greater than the bigger and that the degree of bed contraction increases with the liquid velocity but seems to level off at higher velocities. The model explained the change resonably well.

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Structure Analysis and Estimation of Physical Properties of Coal Derived Liquids

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Summary

A systematic structural analysis by high performance liquid chromatography (HPLC), nuclear magnetic resonance (NMR) was proposed to estimate the physical properties of coal derived liquids. Coal derived liquids were distilled into 26 narrow boiling range

fractions covering 473-650 K. These fractions were furthermore separated into 5 compound classes ; alkanes, monoaromatics, naphthalene type diaromatics, biphenyl type diaromatics and polyaromatics by using a HPLC with an NH_2 column. In this study, the chemical structures of these compound classes are characterized by 7 atomic gropus : aliphatic methyl groups, aliphatic methylene groups, aliphatic methine groups, aromatic protonated carbons, aromatic substituted carbons, aromatic internal carbons and naphthenic rings. The concentrations of these atomic groups are calculated from NMR data. Based on these analytical results, density of the compound classes are estimated by the atomic group contribution method. The chemical structures of compound classes are also characterized by GC/MS. Structural parameters thus obtained were consisting with 5 atomic groups and correlated to boiling point of compound class.

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Neutron Radiographic Observation of High Pressure Three-Phase Fluidisation

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Summary

Beds of coal particles and kerosene were fluidised in a 10 mm thick 2-D bed and in a 53 mmϕ circular 3-D bed by hydrogen or nitrogen gas supplied through single nozzle at room temperature and pressures up to 8.2 MPa. The bed behaviour was observed by neutron radiography using a compact cyclotron. The result of computer analysis of the video films showed that at the same linear velocities the gas holdup for hydrogen increases rapidly with the pressure for the range less than 1.0 MPa and then levels off for the higher pressure. On the other hand, no significant change was observed in the holdup of nitrogen gas. Also, the extent of bed surface fluctuation was found to be dependent neither on the gas species nor on the system pressure.